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Engineering Topology of Photonic Systems for Sustainable Molecular Structure: Autopoiesis Systems

Moustafa Osman Mohammed

***Abstract*—**This paper introduces topological order in descried social systems starting with the original concept of autopoiesis by biologists and scientists, including the modification of general systems based on socialized medicine. Topological order is important in describing the physical systems for exploiting optical systems and improving photonic devices. The stats of topologically order have some interesting properties of topological degeneracy and fractional statistics that reveal the entanglement origin of topological order, etc. Topological ideas in photonics form exciting developments in solid-state materials, that being; insulating in the bulk, conducting electricity on their surface without dissipation or back-scattering, even in the presence of large impurities. A specific type of autopoiesis system is interrelated to the main categories amongst existing groups of the ecological phenomena interaction social and medical sciences. The hypothesis, nevertheless, has a nonlinear interaction with its natural environment 'interactional cycle' for exchange photon energy with molecules without changes in topology (i.e., chemical transformation into products do not propagate any changes or variation in the network topology of physical configuration). The engineering topology of a biosensor is based on the excitation boundary of surface electromagnetic waves in photonic band gap multilayer films. The device operation is similar to surface Plasmonic biosensors in which a photonic band gap film replaces metal film as the medium when surface electromagnetic waves are excited. The use of photonic band gap film offers sharper surface wave resonance leading to the potential of greatly enhanced sensitivity. So, the properties of the photonic band gap material are engineered to operate a sensor at any wavelength and conduct a surface wave resonance that ranges up to 470 nm. The wavelength is not generally accessible with surface Plasmon sensing. Lastly, the photonic band gap films have robust mechanical functions that offer new substrates for surface chemistry to understand the molecular design structure, and create sensing chips surface with different concentrations of DNA sequences in the solution to observe and track the surface mode resonance under the influences of processes that take place in the spectroscopic environment. These processes led to the development of several advanced analytical technologies, which are automated, real-time, reliable, reproducible and cost-effective. This results in faster and more accurate monitoring and detection of biomolecules on refractive index sensing, antibody–antigen reactions with a DNA or protein binding. Ultimately, the controversial aspect of molecular frictional properties is adjusted to each other in order to form unique spatial structure and dynamics of biological molecules for providing the environment mutual contribution in investigation of changes due the pathogenic archival architecture of cell clusters.

***Keywords*—**Autopoiesis, engineering topology, photonic system molecular structure, biosensor.

I. Introduction

NANOSTRUCTURED molecular polarity cannot be characterized by symmetries, in contrast to other states that have been designed and fabricated by palladium nanostructure onto two-dimensional photonic particles [1]-[3].Similarly, considering symmetry has a crucial-reflection when determining the possible topological phases of a system. . The term 'topology' is confused with 'geometry' [4] when a molecule's orientation referenced to the surrounding structures [5]-[7], as intra-molecular chain orientation [8], [9]. Molecular structure applies valuable tools from their topology and graph theory to understand the synthesis of complex, functional organic molecules [10]. The number of structural elements and proximity within the molecular cell [8], [11] describe permutations in primary sequence [12]. In other words, molecular structure in two-dimensional flux is threading with a magnetic field that exhibits a higher-order of a macroscopic phenomenon [13]. This internal structure is called the order, the topological order for fabrication processes is discovered in vacuum chamber with the aid of an electron gun and sputtering deposition methods [14]-[16]. The explanatory model is described in the two-dimensional structure of photonic band gap into visible spectrum and the palladium nanostructure constructed as 11 nm thin film onto the photonic systems [17].

A primary theme in the explanatory model of concurrent engineering knowledge and basic area experience is unified for general design theory. The term 'general design theory' (GDT) is used by Yoshikawa (1981) [18]-[20] in the nature of design-manufacturing of engineering components. The ability to design in a scientific manner with a methodology reveals the general theory of using computer-aided design (CAD). The development of CAD tools preserves, automate and speed up the design process of systems and become an active research area in both industry and academia. Nonetheless, the advance modification is leading to approve strong design predictions of the nominal geometry variations within system equilibrium behavior as a flexible framework that empirically presents guidelines for unifying theories, methods, and tools related to design molecular topology [21].

Frequency, wave vector, polarization and phase are degrees of are often used to describe a system. Over the past few years, topological transition is verified as a property of a material that

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Moustafa Osman Mohammed is with the Egyptian Environmental Affairs Agency, Egypt (e-mail: moustafa_o@yahoo.com).

characterizes global behavior of the wave functions on its entire dispersion band. Other properties have emerged as another indispensable degree of freedom, thus opening a path towards the discovery of fundamentally new states of light and possible revolutionary to enrich the design and use of applications. [22]. Potential practical applications of topological systems include photonic circuitry that is less dependent on isolators and slow light particularly insensitive to disorder [23]. As the notion of topology naturally occurs in many different fields of mathematics it makes it a fundamental concept. In the mathematical sense 'topology' can distinguish linear chain, branched, and cyclic topologies [24], [25]. The consequences of topology have a powerful tool to address issues, as yield in uniting system structure among diverse molecules and more complex materials [26]-[28]. The system physical properties has described its topological invariants as a branch field of mathematic of the object's that remain constant under a certain kind of continuous, invertible, and one-to-one transformation (i.e., bending, stretching, and shrinking) which determines the topological classification of different materials or structures and nowadays known as part of 'algebraic topology' [29].

The field of topology is manifesting in many branches of physics for understanding on state of matters. The different fields of topological objects are mathematically characterized by integers called 'topological invariants' — quantities that remain constant under arbitrary continuous deformations of the system. The topology of certain objects has recently become a rapidly growing field since artificial structures are theoretically designed for constructing topological states, especially in a promising large-scale implementation of CAD systems. Meanwhile, it is still an elusive problem to directly measure the integer topological invariants and topological phase transitions with a computer system [30].

A. The Modular Topology

Various modulation methodologies approach the multilevel implementation of modular topology, which is based on the pairwise relations between active and passive components that independently operate to create, modify, replace or exchange patterns of interactions systems. A modular design is characterized into discrete scalable functional partitioning boundaries with selective or collective objects by observation communication processes (e.g., law, science, economy, politics, etc.) that interface other standards systems. In this context at the component level, the boundary of modularity has reflected an architectural of exterior and interior modes in relation to the role of ecosystems as a platform system [31].

The intra-molecular and light perform tasks relate to the traditional sphere of electronics for communication as commonly used modular components. The contacts sphere is a delegated field of research area specifically responsible for utilizing selective or collective modular for mapping wide range applications. The modular relations are applied to various systems and intra-molecular contacts. The modular topology notably chooses a type of contact, that is well-defined in physical and chemical properties for mapping structural applications that include personal health monitors and biomedical devices, [32] electronic monitoring, [33] display, [34] with flexible nano-membrane photonic crystal cavities, [35]-[38] stretchable silicon photonic waveguides to filters, [39] and flexible nanoantennas array [40]. The selective and collective modular topology rules can help in innovation molecules with the same specific topological features.

The electronic is extremely flexible from the technical point of view[32]-[34] and possibly known as flexible photonics, [35]-[40] that is aiming to achieve electronic and photonic circuits, devices, and modular systems on flexible, stretchable and biocompatible media. The systems can communicate in three types of relations between two contacts: parallel, series, and cross that modular topology does not necessarily inform on the free energy in circuits. The π loop formation in an idealized chain comes with entropic scales to function with the inverse loop size [41]-[43]. The specific modules intersection is attributing physical and chemical properties with appropriate structure as determined solutions for mapping multivariate information. This allows the model to interrelate equilibrium of social behavior to systems ecology, since mapping equilibrium of system behavior is another abstract, defining social behavioral as cultural stimuli to appropriate phenomena. However, unities can fulfill dynamic forces as an open set of the subset functions topology to associate 'behavior topology' as open sets of interior and exterior systems and interrelate molecular polarization are another abstract of cell diagnosis problem of anthropogenic insertions onto possible failure-safe modes and effect on the environmental systems [44].

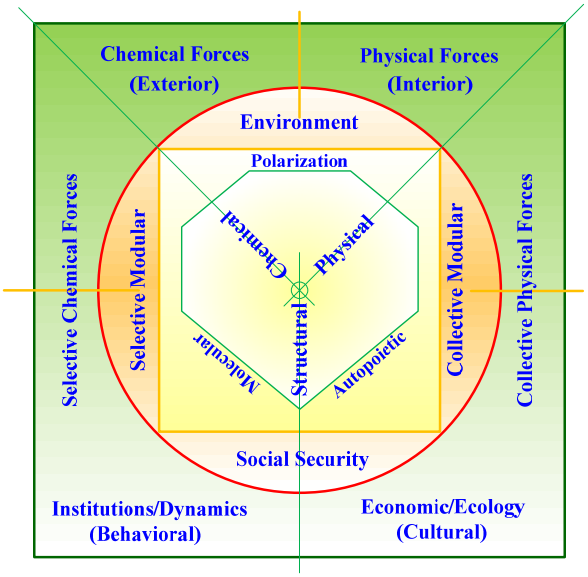

Fig. 1 The Systems Modular Topology [45]-[49]

Fig. 1 contains a lot of arbitrary assumptions, and there are many inconsistencies between quadrants and levels. These levels are connected and can communicate with each other in situations across all levels of processes. The structure of the object has been coined with physical and chemical properties to describe these engineered and interconnected systems. However, a viable hypothesis related molecule cell to integral

molecules based on symbiotic relationship as revolutionary mechanism possibly explains ecological impact. These molecules are composed of proteins (i.e., absent in Fig. 1, but they would be located at the cultural of the economic/ecology, right quadrant), proteins of molecules, molecules of atoms and the diversity of molecular structures as its functions are considered one of the key scientific challenges in biology [50]. Proteins have, for instance, been classified by visual inspection [51], geometry [50], the nature of transition intermediates [52], and the spatial arrangement of secondary structures [53], [54]. Therefore, the topology in molecular knots occurs naturally in the biological system and has been socialized for technological applications. On the scientific level, a flexible system (e.g., electronic or photonic) can be transit to bent and fold nodes to allow involvement of spatial topology for mapping edge states by the dynamic topology of network interaction. [55].

In the selective modular, topology is describing elementary features of the molecules structure [56], [57], not only for classification but also for setting physical structure of molecule properties. [58], [59]. Moreover, the relevant topology to molecule [60]-[64] is setting molecules with complex topologies to display emergent properties [65], [66], and provide guidelines for chemical synthesis [67], [68] for topological classifications. Theoretically, it is possible in systems ecology to construct internal 'patterns', 'processes' and 'structures'; however, these internal orders presumably have different performances in any other known orders and cannot be observed within any conventional states. They are not associated among any symmetries (or the breaking of symmetries), and cannot be described by theory to satisfy innovation requirements. The topology includes these three situations: (i) topology selection or collection which involves picking another topology from an existing pattern of schematics, (ii) topology refinement physiochemical processes that incrementally and modifies existing topologies, and (iii) topology synthesis creating or innovating in the structure in a completely new modular using optimization-based techniques [69]-[71].

These topological orders have a whole new theory to describe functions stated, gain some intuitive understanding of atoms occupy fixed positions in a positional order, and describe an atom's positional order relative to other atoms. The electrons do not have any positional order but, move randomly inside each other in a highly correlated manner. Such correlation motion represents the internal structure of state functions and associates the environmental resilience to the behavioral of systems equilibrium. However, the evolution of disturbances in complex systems as the principle of dynamic interactions of molecular topology are away from coupling quantitative analysis in a system self-assemble structure for polarity equilibrium [72]-[74].

B. The Autopoiesis Systems Topology

The molecular topology is influenced with interior and exterior modes that broadly interpret social, cultural and ecological interactions. These various interactions focus on interconnections biological and ecological systems, among social, economic, political and cultural behaviors of autopoiesis systems. The diversity of factors is required for perceptions of reality into sensible devices, in order to control composite unity by self-organizing components, proposing a new concept based on understanding resilience and stability of ecosystems: autopoiesis systems [75]-[77]. The autopoiesis system is added as organizationally closed and structurally determined. This has been described as the system's autopoiesis as preserved within the resilience state, adaptable only to structural fluctuations for as long as the disturbance entity survives within, and can be structurally coupled to its environment; otherwise there is termination. The autopoiesis of the systems ecology is not strictly autopoietic, it assimilates behavior from an active and passive environment and therefore, creates interactive relations that occur on a sensory surface to be embodied in a pattern as neural activity. Since the essence of neural activity involves behavior and is influenced by the environment it encompasses, as traced in Fig. 2 [78], to coordinate dynamics interrelation of systems model within the framework of systems ecology [79].

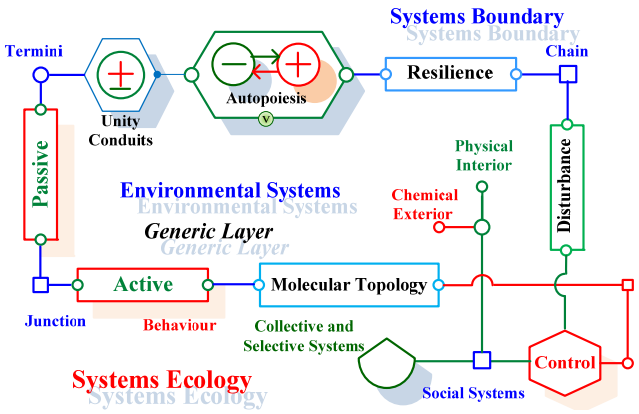

Fig. 2 Autopoiesis Systems Topology [78]

The autopoietic hypothesis is not necessarily exclusive to the type of paradigm for (biological) living systems as it has been described. The topology of autopoiesis systems is attributed to continuously and periodically produces relations among their components through a dynamic process. The relations of components allow them to continually reproduce the same pattern of self-defined boundaries. These boundaries use energy systems to organize physical matter into particular dynamic arrangements. These different arrangements, in turn, are capable of producing the necessary components and organizing them in the necessary pattern to produce their own boundaries through 'preferential neighborhood interactions' for their own continuation. The ability of these self-organization systems to belong their categories to the same pattern with the three coupled subsystems will have an important role in the formulation or mapping of topological notions as introduced so far as: boundary, relation, and variation and transformation [80], [81].

The boundary defines system as entities separate from the non-system. These invariant properties between network topology are created physical self-boundaries under continuous variation and transformation. These intuitive connectivity

reflect the total number of chain ends (termini) with the total number of branch points (junctions), , the number of branches at each junction, the connectivity of the junction are in linear chains (e.g., polymers) and the relations belong to the same feature of topological class and thus topologically identical [82]. The direct inter- and intra-molecular interactions mean that, complex synthesis is used to place particular organic and inorganic groups near one another in order to increase stability of the knots and rings with more precise functions for controlling sub-molecular motions of the entire molecule. The interlocked molecules motion is leading to the creation of novel functional molecules which change their properties in response to some external stimulus (e.g., light, electricity or a chemical reagent).

Therefore, the efficient preparation of molecules is exhibiting functions of interlocked molecules to be a virtually established point of any molecule, prohibitive for practical applications [83]-[85]. These molecules stated the creation of assemblies as device-like properties to form the basis of a molecular machine and device. These molecules are predicted to be a key protagonist in the development of nanotechnology. The interlocked molecule of mechanical system is an intriguing synthetic target because of their promise in the pursuit of electronic paper, nano-valves, molecular switches, and other nano-electronic components [86], [87].

C. The Photonic Systems Topology

Photonics have found applications in a broad range of scientific and technological systems that are practically limitless and include medical diagnostics, organic synthesis, communications, as well as fusion energy. Photonic systems topology is considered to be one of the emerging research fields. The spectroscopy offers a principal means for biological structure analysis as well as none intrusive measurements. Among other fields, topology has the ability to prototype the device as a gas sensor with the long-range surface resonators in different injections of gas and sensor head to sense gases at ambient temperature [88]-[90]. A reversible application of the reflectance deep of the long-range surface resonators makes this sensor an efficient device in medical, safety and energy systems [91]-[95]. The resonant devices of electrodynamics circuits are coplanar waveguide microwave resonators that have two-dimensional microwave analogues. The coplanar has waveguides of a signal carrying centerline flanked by two grounded planes [96]-[98].

The planar structure is suited on a dielectric substrate by a photolithographic process that uses aluminum (Al) or niobium (Nb). The typical substrates are either oxidized silicon (Si) or sapphire (Al_2O_3) as dielectrics for line impedance of the geometric properties that are given to match the 50 Ω of the peripheric microwave equipment to avoid partial reflection of the signal [99]. The electric field is confined in ranges between the center conductor and the ground planes as a result of a very small volume (V_m) that rises to a very high electric fields per photon (E_o) [100]-[102] (i.e., as a comparison with three dimensional cavities). Mathematically, the energy of photon fields is given by:

$$E_0 = \sqrt{\frac{\hbar \times \omega_r}{2\varepsilon_o \times V_m}}$$

where ħ is the reduced Planck constant, ω_r is the angular frequency, and ε_0 is the permittivity of free space.

A direct observation of topological invariant is providing a winding number by using bulk state photon dynamic on a chip as topological phase transition points via single photon dynamic [103]. The direct measurements in the single-photon regime is integrated topological structures with strong robustness against disorder and add the key elements into the toolbox of the 'topological photonics' to enable topologically protected information processing in large a scale [104]. Different to many other fields in physics, the properties of objects in topology can predict geometry such as squares, circles, and triangles in the same topological class for transformations. In an instant approach, the objects geometry and topology of space and time are endowed physical reality [105] as well as extended photons in the virtual space-time structures [106]–[108]

II. Approach Topology in Engineering Design

Engineering design requires the ability to communicate about objects of design and sets of constraints among a diverse group of engineers, designers, manufacturing personnel, and other team members. Topology is applicable as collective tools for formally expressing relations amongst sets and issues critical to tolerance at the design–manufacturing interface [109]-[112] with other design–manufacturing interface [113], [114] to share fundamental topological concern. The phrase 'topology of design' is frequently used informally to refer to how components of a design are typically connected one another without change in the systems ecology [115], [116].

Recent advancements in genetics and proteomics have led to understand how a cell's behavior arises from protein and gene interactions. The dynamic interaction between cellular network components is largely unknown for key cellular networks for mapping protein–gene network interactions. These local perturbations are confined to network nodes and propagate through the entire network of direct connections entire nodes.. Thus, the approach of 'reverse engineering' where the connection architectures are inferred from the perturbation response data, become increasingly appreciated [117]. Although reverse notion of metabolic closure is presented and analyzed in terms of engineering methods such as Boolean networks [118], Bayesian networks [119], [120], dynamic Bayesian networks [121], [122], multivariate regression methods [123]–[125], linear programming [126], genetic algorithm [127] and information theoretic [128]. These approaches are modeling genetic regulatory networks because of its probabilistic nature. Considering the explanatory models, deterministic input-output systems that decomposed into a differential state equation with a nonlinear output or functions. The algorithm is applied (i.e., information theoretic) to deduce the circuitry of signaling and gene networks. The primary theme of inferred methods has significant limitations in modeling internal nodes. These limitations are based on

Boolean network as compliance with increasing internal nodes. [129].

Information theoretic approaches do not predict the different directions of interactions which are significantly important in stand points of the signal flow via biological pathways [128]. The use of genetic algorithms to select filter component sizes and filter topologies is presented in [129], [130]. A comparison of genetic-based techniques applied to filter design is presented in [131].These methods has been reviewed to set its advantages and limitations as mentioned in [132] . In another opinion, the basis of an algorithmic approach in optimizing engineering design is different from traditional mathematics of engineering science. The topology is serving as the foundation for any maturing mathematics of design, as a fundamental aspect of structure on certain subsets of a set, and properties of that structure may reflect conceptual aspects of the design domain. In this research, the topology in engineering design is described as the ultimate goal into the scientific basis of systems ecology [133], [134]. The attempts to classify and abstracting such parameters of topological perspective have not yet been achieved to catalyze the shape of structure. The rule of topology design is abstracted in polygon which represents a set of functions that are needed during reproduction, recombination, mutation and selection of collective control. These featured-based relations denote possible tolerances to illustrate how the diverse topological techniques (i.e., chemical and physical properties for analyzing the structure of biological molecules) are integrated by characterization molecular mechanisms in transformation and measured with life-cycle activities (LCA) [135], [136].

A. The Rules of Topology for Feedback Folded Chains

Science does not stop producing theories on the basis of the possibility that new discoveries might revolutionize the idea of distinguishing sharply and ultimately between both necessary and contingent aspects of the physical and chemical properties. Systems are reviewed, defining especially self-referential equations like $f(f) = f$ and related to autopoiesis to another theory centered on metabolic closure, speculating how an algebraic view of metabolism could be used in the analysis of metabolic pathways. The mathematical framework is used to prove and understand particularly difficult problems with basic construction patterns. In essence, the mathematical view of metabolism consisted in the biological functions of replacement or organizational invariance with procedures to select or either collect mappings. Although the explanatory model is discovering forms of feedback chain, and understanding the importance of biology for developing as well as improving a theory of living systems. The explanatory model addresses the design structure of chain network to determine appropriate topology assembly, supply and produce the best functions with cluster architecture to minimize the failure–safe in the folded chains. Generally, inactive proteins produced due to failure to fold into native structure, but in some instances unfolded proteins are modified or have toxic functionality. Several diseases are resulted from the accumulation of amyloid fibrils formed by unfolded proteins [137]. Several neurodegenerative and other allergies are caused by incorrect folding of some proteins, because the immune system does not produce antibodies for certain types of protein structures (shapes) [138].

The basic model determines regions that should be configured as the best route to set up chemical transformation for building boundaries and coupled with determined structure that relate between the same patterns of design solutions. The cluster design is analyzed to describe and make spatial and temporal comparisons of communities (assemblages) of organisms in heterogeneous environments. . The cell cluster behavior-based representations of the basic design knowledge of the geometry of the parts and fixture via cell cluster properties analysis. The virtual assembly is supporting either concentrate solely or uses simulated virtual layout for visualization multidisciplinary competence to approximate human interaction in the assembly process and identify product lifecycle assembled in these systems [136], [139]. The trend is inducing development from micro to macro parameters, resulting in diminished lot sizes due to augmenting product varieties (e.g., high-volume to low-volume production). The micro-macro problem – (i.e., the relationship between the individual actions and resulting social structures and the reciprocal constraint those structures place on individual activity) – has long standing in social science. The synaptic activity is estimated from the blood oxygenated level dependent signals that means of a physiochemical model (Fig. 3) [140]. The modeling and analysis are not only detecting ranges of existing cluster families, but able to analyze and compare cluster, defining new patterns that observed and grouped in a function of features. These physiochemical parameters of the model are estimated in each region to consider spatial variability between linear or nonlinear responses and estimate inversion interactions at the neuronal level in theory, as sensitive to the same structure variability [141].

The three-dimensional structure (shape) of proteins and their precursors is one of the important issues in molecular biology as in the cell, (e.g., deoxyribonucleic acid (DNA), ribonucleic acid (RNA)) and the close relationship between molecular structure and function. Ordinarily, protein and DNA structure are defined by X-ray crystallography, electron and atomic force microscopy and nuclear magnetic resonance imaging (NMR). These explanatory methods often do not provide conclusive evidence for molecular conscience shape in virtual simulation. Because of the close packing needed for crystallization mechanisms at nanoscale, the manipulation is required for preparing a specimen of electron or atomic force microscopy (AFM) for coupling with infrared spectroscope (AFM–IR) to provide another advantage in analysis. This analysis helps to shed light upon the physical structure of polymers for the nanoscale characterization of polymeric materials and the lack of NMR resolution. Moreover, some proteins (enzymes) function as molecular machines, changing their structure as they execute their function, so one static spatial dimension may not tell the whole processes' indices. The topological approach to enzymology (Fig. 3) [142], [143] is an experimental protocol in which the descriptive and analytical powers of topology as well as geometry are employed in indirect efforts to determine

enzyme mechanism and the structure of active enzyme-DNA complexes *in vitro* (i.e., in a test tube) also *in vivo* (i.e., in the cell). In recent control, possible knots of the organic molecules are self-assembled into compiled close trefoil knots, in a process driven by hydrophobic interactions [144].

The topological approach to enzymology is described with mathematics from the observed changes in DNA geometry and topology to deduce enzyme binding and mechanism. This observation requires the construction of mathematical models for enzyme action and the use of these explanatory models to analyze the results of topological enzymology experiments. The typical design is a set of candidate functions as considered and each function will usually have unintended behaviors. The similarity (or difference) of the functions can be measured in terms of molecular topology to study the structure of abstract design concepts of functions, attributes and their relationship. The influence of molecular properties is unifying methods and tools related to the representation of a design model to rapidly treat genetic diseases by comparing the molecular structures of DNA and their proteins found in the cell to known or desired reference structures. The infections can be edited or recovered with replacement therapy synthetic molecules in place [145].

The optical triggering with nanosecond laser pulses has made it possible to investigate the fastest–folding proteins as well as the fundamental processes in folding for the first time. Over the past decade, major advances have occurred in both theoretical and experimental approaches of investigating protein-folding mechanisms [146]. The protein-folding problem is generally divided into two parts. In the first, the goal is to predict the three-dimensional structure from the amino acid sequence. The second part is the no-less daunting task of understanding the relation between protein sequences and mechanisms of folding. In protein folding, the mechanism is the microscopic distribution pathways that connect the myriad structures of the denatured state with the unique structure belonging to the native state [147].

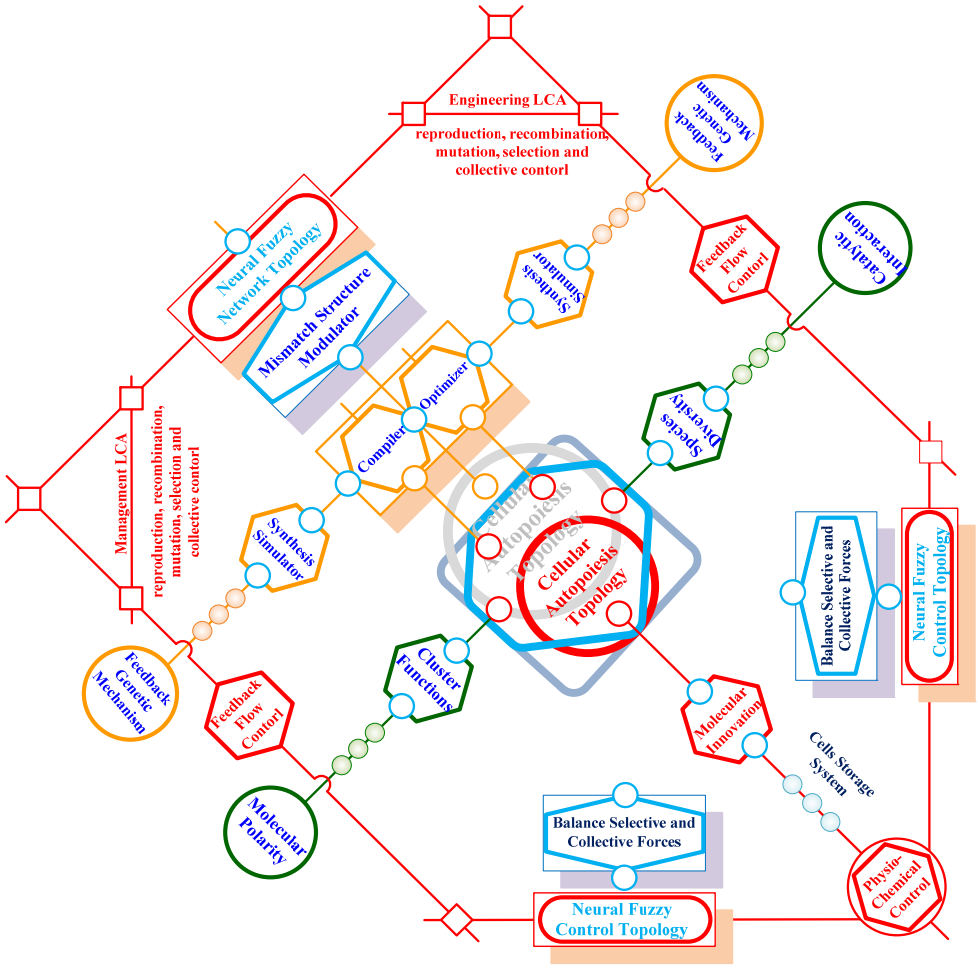

Fig. 3 The Feedback Control Folded Chains System [142], [143]

On the technical level, a flexible topological photonic that supports robust topological photonic states is extremely desirable for applications. These applications are supporting the emergence of the topological field with flexible photonics to demonstrate how electronic circuits, devices as systems stretched with biocompatible subsets. Recent technology is integrating mixed analog-digital circuits as a complete system-on-a-chip. The folded chain applications as neural information processing systems, speech and pattern recognition systems as well as portable information appliances are accessing the

information superhighway that requires analog circuitry. This should leverage the power of analog design in order to remain feasible and cost-effective. Spatial topologies are constructed via folding, connecting and overlapping the resonator at the top edge with different folding manners. The circuit topology rules relief molecules with specific topological features of the combined molecule, AB; when the topology of B is unknown, the topology rules can derive the topological relations to be inferred in similar functions [148]-[150]. In general, circuit topology rules can help engineering new molecules with specific topological features as a mathematical framework to systematically explore the space of possible topologies, design molecules with certain topologies, or modify the topologies of existing molecules. The other relations or rules also provide information on topological constraints: the boundaries of topology space-time structure beyond topology which molecules cannot evolve or be engineered [151].

B. The Cellular Topology and Social Equivalence

Over the last decade, the concept of 'social equivalence' has gained institutional and governmental attention as principal mathematical discipline for the required analysis.. However, there is a great use of the design application to deal with variety terms for definitions and interpretation, as different methodologies around. This concept prevents the consolidation of a unified field of new knowledge. The fundamental aim of the basic is to conduct a review of the past and present usage of the concept of 'social equivalence' as the main currents or as starting points to draw conclusions and proposing a theory of socio-ecological transformations. The 'social equivalence' evokes an organismic analogy that builds up or maintains its structures through exchanging premium energy and associate materials with its environment throughout its life. This analogy is warranted for social entities that share some of the key system characteristics of organisms: the ability to place or create and reproduce their own elements, a high degree of internal interdependency between system compartments to reproduce a clear boundary *vis-à-vis* their environment while exchanging energy and materials.

The social topology framework defines whether structures are topologically equivalent to balance interior and exterior stimulus. The 'social equivalence' and equilibrium of systems behaviors play a key role in enabling potential types of detectors or indicators that provide information science for even better precursor performance. The model compares the energy flow in the workplace as traced in Fig. 4 [152], [153]. The graph and an adjacency matrix [154] indicate the number of direct connections between topology terms of social systems. The network is attributed in different topologies in order to balance forces within a remotely self-cleaving satellite and distributed in cluster. However, it also suggests parameters to be equivalent though inter-conversion between the physical and chemical agents that influence endurance species.

The system is presented schematically in the boundary layer reflecting the relation of the transformation and variation between the physical and social components in network topology. The energy flows within the system as a coherent state pulse on the transport channel functionalized with a relevant structure. Upon energy flows, the force acquires a permanent dipole moment with forces that influence an electrostatic potential in the transport channel, changing the polarity in the molecule. The system might be able to detect molecular infection as an obvious reflection because of feedback action. The applications of physical sensing and chemical sensing influence the energy flow on the system when detecting interactions of the transport channel coherently with the molecule, measuring the performance on a continuous measurement of the polarity. The feedback-action from such measurements has been shown to detect destructive structure in infection volume as set in the socialized models [155].

The influence takes place in the strong focusing regime [156]-[159] with the molecular polarity and is reflected in the focal point of the spatial model, matching the autopoiesis systems [160]. The model of the energy system is detected as a cell cluster and molecular polarity for providing energy forces that influence the ground state (g) and the excited state (e). The ground state has no permanent dipole. The photon energy ($\overline{h\omega}$) is resonant with the absorber while the channel is not sensitive to the incoming light pulse (e.g., a small-diameter has well-separated optical absorption peaks due to excitonic effects [161], [162]; the hypothesis assumes that the molecule optical gap is matched to these destructive structure). This can be applied to a single element detector in a narrow band, to detect stabilization or forces equivalent but an array of such elements could be broadband or even or perform energy resolution. These recently discovered synthetic molecules have great functionality in the future century technology, as computer-aided drug discovery/design methods for therapeutically development of small molecules until understanding the roots of molecular topology that explores the synthesis and application of topological molecules.

III. The Feature of Molecular Structure

Molecular structures are astonishingly complex and diverse that certain structural features can be highly conserved. The classical concept of molecular structure (i.e., namely, a set of atoms in space with a well-defined geometrical arrangement) has originated in the advent of polarity theory, and contrary has widespread views; these two conceptual schemes (i.e., classical molecular structure and polarity theory) are not easy to reconcile. The preliminary approach of molecular structure in terms of space and time correlations is in the framework of atomic theory. The electronic model of photonic system is implying for the molecule structure with its chemical and physical properties.

Recently, the developed theory of 'topological chemistry' predicts physiochemical properties in band structures of each photonic level. This hypothesis model allows us to design and diagnose topological photonic band structures using only group theory and linear algebra. A primary theme of selective or collective topics is focusing on group of elliptical rods in a 'quadruple lattice' that the symmetry of Bloch states in the Brillouin zone are determined the position of the localized

photonic wave packets describing groups of bands. Similarly, the model is controlling the propagation of photons in periodic dielectric structures (i.e., photonic crystals) by modifying the nodes of physical structure and inverting bands to describe how centres of these wave packets are moved between different positions in the cell. In crystals, the individual constituents are arranged into a highly ordered microscopic structure, forming what is called a crystal lattice. Materials science is an interdisciplinary field, building on physics, chemistry and engineering or even on metallurgy and mineralogy. Modern material modeling spans a wide range of techniques, from finite-elements methods to atomistic simulations. The hypothesis shapes dielectric rods and isolated topological bands to be admitted as a well-localized description based on representing the first physical instance of topology in an inactive system. The model demonstrates how photonic crystals are the natural platform for the future investigation of fragment topological bands. Because photons in linear dielectrics are inactive, and since they can be cheaply and easily engineered with almost any desirable lattice structure, two-dimensional photonic crystals are an ideal playground for studying topological band theory.

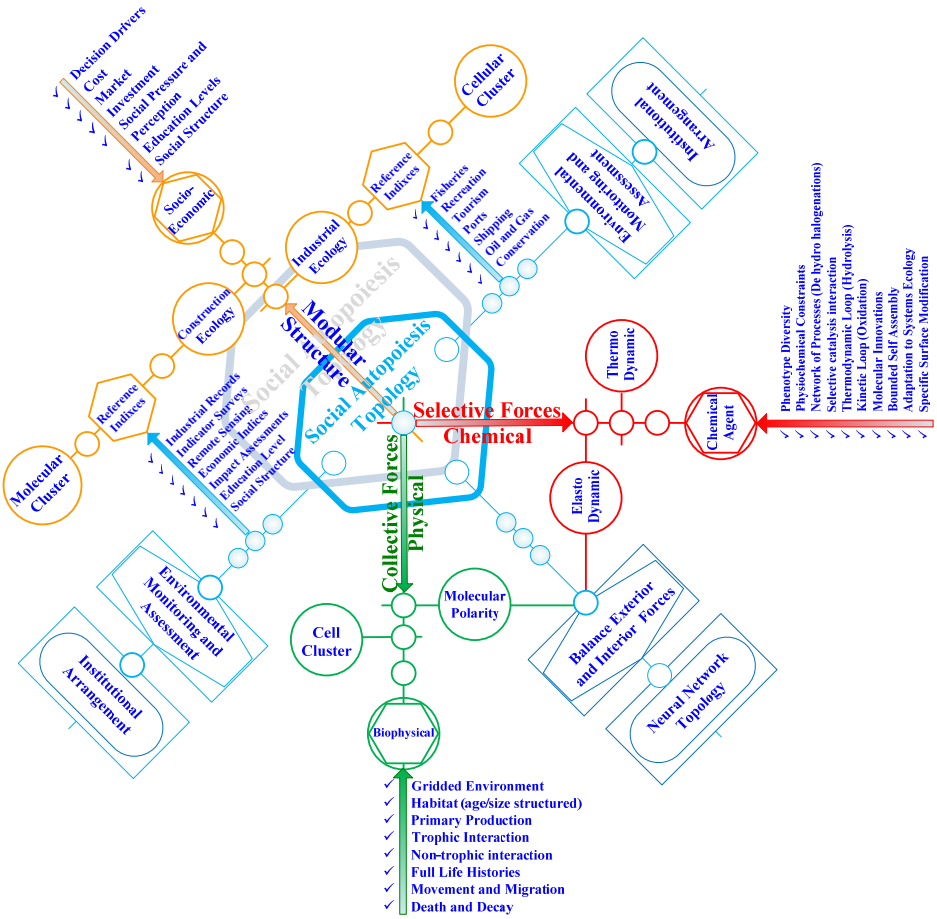

Fig. 4 The Forces Influence Social Network Topology for Equivalence [152], [153]

The features of some critical views rose during recent years concerning the concept of molecular structure. The model focuses on "molecular structure" where an intrinsic attribute of an isolated molecule appears rather as an effect of the environment (e.g., vacuum electromagnetic field, according to molecular electrodynamics?). These issues are necessary to distinguish between a "polarity" and "potential" structure (e.g., which may be deduced in a straightforward way from the polarity treatment of the molecule), and the "classical" molecular structure (e.g., according to the other molecules that detect as a set of rotating and vibrating material points, in correspondence to the atoms).

The mathematical basis of chemistry had been laid by Schrödinger in 1926 [163] that deduces that the "classical structure" concept is non-trivial from a purely molecular-mechanical point of view; in actual fact. The direct solution of the Schrödinger equation [164] is called molecular dynamics, within the semi-classical approximation of the molecular dynamics that related to "classical limit" of atomic mechanics, and it appears that, none of these classical concepts and behaviors is convincingly derivable from basic concepts of molecular mechanical basis. In classical consideration of stochastic electrodynamics (SED), molecular polarity properties of waves and particles as well-coordinated emergent

effects to be proposed in the stochastic models of microphysics as alternative or extension of usual atomic theory. Finally, the framework of the "classical limit" theory and, in particular, the "classical molecular structure" no longer poses a problem, but in qualitative aspects, several quantitative failures of SED inhibit accepting it, at least in present state, as a genuine physical alternative to atomic theory. Therefore "classical molecular structure" and classical concepts in general, remains an open research spot in the framework of present-day atomic physics [165].

A. A Circular Organization Approach Formal Structure

The conceptual framework is adopted cellular metabolism to catalyze and elaborate the formulations insights and then encapsulated. The cellular membrane has a boundary structure formed to form a three-dimensional sheet (i.e., the automaton considered here has three-dimensional cellular automaton model [166]). A component transforms a set of input materials into output materials. Enzymes represent components as they transform reactants into products without being changed topologies (i.e., the transformation of reactants into products does not migrate processes or propagate any topology changes information that received on the physical configuration).

The metaphor is formalized a metabolic network and interconnected biochemical reactions with a metabolic map in terms of components and metabolic processes indices. The molecular structures are analyzed by x-ray and UV photoelectron spectroscopy (XPS/UPS) in combination with near-edge x-ray absorption fine-structure (NEXAFS) measurements. The dispersion-corrected density functional theory (DFT) calculations provide a detailed understanding of the surface chemical bond and its physical dependence on the π topology (i.e., a circular organization). This chemical bond is initially distinguished with two types of entity: chemical production and physical repair components (i.e. transformable materials and energy).

Chemical Production: these components are formed to balance a reaction between two objects as substrate molecules A: A + A → B. This reaction occurs inside the enclosed volume by the membrane. In the original formulation by [167], this reaction is attributed to the presence of catalyst enclosed within the membrane. However, since the catalyst itself is not produced by the system, this system is defined as autopoiesis defined by the s-referential objects $f(f) = f$. Here, the proposed structure to consider this reaction A + A → B is catalyzed by the inside surface of the membrane, that is, C_i catalyzes the production -of (B). In "real" nature of living systems, each component (B) is a physical entity with a finite lifespan. Therefore, the self-production is an upper limit to the concentration of (B) that self-referential equations like $f(f) = f$ can be determined to accumulate within the membrane and build the selective or the collective procedure.

Physical Repair Membrane and Permeability: The intact membrane is impermeable to the *B* components, which thus accumulate inside the membrane. The *B* components diffuse freely within the volume enclosed by the membrane. In the preceding analysis, a linear relationship is assumed between the voltage across a channel and the current flow. The topology of the molecular π system drastically influences its molecular interaction with a coincide surface. The incorporation of non-alternant structural elements in molecular semiconductors used to control. The molecular is optimized with functional performance of metal-organic interfaces. These recent achievements are structurally complex, non-alternant, aromatic molecules, [168]-[171] providing a feasible cost in novel applications. Based on drift and diffusion of an ion in a channel, as well as on Maxwell's equations [172] ultrahigh vacuum (UHV) conditions explore how much current should flow. If two single *B* components collide, they do not combine. However, if a free *B* component collides with the edge of a hole in the membrane, it attaches to the surface and repairs the hole—completely if the hole is of size C_1 (where *C* is the area on the membrane occupied by a *C* component), partially if the hole is bigger.

A *B* component that integrates the membrane in this way thereby becomes a *C* component. If the hole is larger than C_1, there is a finite probability that the B component will pass through the hole without attaching to any of the free edges for maintaining function. This probability increases with the size of the hole. Thus, the membrane is completely impermeable to *B* if there are no holes, or the holes are of size C_1; it is partially permeable for holes of size larger than C_1 (i.e., in practice, in the discrete model, B components will attach if the size of the hole is less than about 10C.). This formalization is generalized to embrace a complete metabolic network made of thousands of coupled biochemical reactions (i.e., metabolism + repair → replication) as: $f(f) = f = \Phi(b) = 1$ when b is a function of *C* (for some $b \in C$) and where Φ implements the *repair* function in an autopoiesis system thus plays the role of subsystems components. This formulation focuses on the transformations of the *material* elements *A*, *B* (i.e., single molecules inside the equilibrium volume), where *C* has the same components when aggregated in the membrane and the end product *D*. Thus, these concentrated on fluxes of matter and since the sequential processes $A + A \rightarrow B \rightarrow C \rightarrow D$ are all considered to occur spontaneously [173], the overall result is considered $A+A \rightarrow D$ and corresponds also to a dissipation of *energy* ΔE. This tessellation automaton is a dissipative structure [174].

B. The Formal Structure and Autopoietic Systems

Autopoietic theory, or autopoiesis, is a self-boundary attempt to define physical boundary of living systems as physiochemical open (dissipative) systems, but with a degree of autonomy [175]. Autonomy or independency is a general framework predicting their fundamental circular organization. An autopoiesis machine is organized as network of processes of production components. It is particularly useful when considering the formal structure of π topology at different scales for specifying topological domain of its realization (i.e., transformation, destruction or interactions). In neurodynamics, there are groups of effects classified into structural and physiochemical effects [176]. This recent distinction arises from a simple view of neuronal responses, as the main response

of an input-state-output system defined as an "observational domain". The formal structure is specified in terms of a state equation and an output equation. The perturbations u of π topology (i.e., modular process) initiate changes in the states (processes) x that depend on the parameters θ (configuration). In return, the system's configuration (i.e., the cellular behavior), traces a history function of the system's configuration, or structure. It is a function of the history of its configuration and of its processes to find self-referential objects. The state equation can be function of steady state conditions as:

$$\dot{x} = f(x, u, \theta) = 1$$

where, x are the neuronal states, u are the extrinsic inputs and θ are the model parameters. The output equation links the observed neuronal states x to the measured data y using a linear instantaneous function g:

$$y = g(x, \theta) = 0$$

The function (g) has more complex derivation, because of differential processes of physiochemical parameters at the origins of the blood oxygenated level dependent effect: (i) the synaptic activity of triggers has vasodilator signal that induce change in blood flow; (ii) according to the biophysical or generative models [177], changes in blood flow lead to change in blood volume and in deoxyhemoglobin concentrations. In comparison, in electroencephalography, the (f) function is rather complex (i.e., linear differential delayed equations) because the model examines network of processes as neural dynamic to control invariances. The (g) function is extremely simple model used for mapping source and localization variations in a linear product of the cell polarization (i.e., part of the neural states that estimated via f) as polarity functions by the lead field of each region of the formal structural model (i.e., the influence of one region exerts on another and coupling among observed domain as neuronal activity in different regions).The parameters (θ) are the coupling parameters (i.e., interaction connectivity or transformations) and hemodynamic parameters which control changes in the blood flow, blood volume and deoxyhemoglobin content. For magnetoencephalography [178] /electroencephalography [179], they are inhibitory and excitatory synaptic time constants and efficacies, intrinsic and extrinsic connectivity, and propagation delay. The synaptic activity is estimated from the blood oxygenated level dependent signals by the means of a biophysical model. In other words, the parameters are given as a data set with known stimuli in biophysical phenomena. These spatial data are not grounded, generative but represent a principle base of mechanistic system for EEG/MEG data fusion and explain neuroimaging data from a signal processing point of view. The un-confidence data are related to the EEG/MEG signals because underlying neural networks are not clear. Therefore, coupling process parameters are simulated by perturbing cellular network environment for measuring response time and explaining perturbations, (i.e., stimuli, in terms of context-dependent coupling), to detect tolerance in differences cellular shape and topologies. These perturbations elicit changes in unobserved domain as neuronal activity simulated in neural networks and transformed into macroscopic neuroimaging data. These parameters use modality-specific model and correspond to the mapping from biophysical phenomena [180].

IV. Conclusion

The hypothesis is proposed for extending the original concept of autopoiesis as one that can be interpreted for general systems (living or otherwise). Thus extending multifarious mechanisms of second-order cybernetics previously gained some popularity in applied psychology and in social sciences [181]. Such interpretations of autopoiesis is applied to a number of disciplines such as cultural, social institutions, corporations, policy, educational, small and medium enterprises and legislative systems. The photonic systems as closed self-organized entities operate themselves on the basis of communication to select or collect whatever on a stream of possibilities that have already been coupled or communicated, to be in the form of utterance, information and understanding contributing towards streams of broadcasted contextual information.

Topological photonics is emerging geometrical idea and couples the behavior of molecules to produce the invariant properties under continuous deformation. Topological invariants are commonly used in mathematical models to classify topological spaces as . explored in topological physics to distinguish the bulk properties of selective or collective materials. When physical and chemical properties are expressed as topological invariants, they can only vary discretely to affect small perturbations of system parameters. The inspiration of the topology in a condensed matter, have recent advances to be applied for engineering analogous effects leading photons to the remarkable phenomena such as the robust unidirectional propagation of light, which holds great promise for applications. However, the flexibility and diversity of photonics systems is being innovated for opening up opportunities for realizing exotic topological models and to probe and exploit topological effects in newer ways.

This article reviews theoretical development in topological photonics across a wide range of experimental platforms, including photonic crystals, waveguides, metamaterials, cavities, optomechanics, silicon photonics, and circuit atomic electrodynamics (AED). The field of circuit AED is a prominent example for atomic information processing and is a promising candidate for future photonic computation. Currently there are two main approaches for physically implementing a computer systems ; analog and digital. The analog approach is further divided into atomic simulation, atomic annealing, and adiabatic computation. Other digital computers use atomic logic gates to do computation (i.e., the realized artificial atom in circuit is called a cooper-pair box, also known as the charge bit).

The spatial datasets are deployed with optical nonlinearities for leading relations toward innovative phenomena of light within bioinformatics (i.e., the spatial informatics and the

Geographical Information Systems (GIS)), where the spatial data are defined as a vertex of cellular network topology (i.e., a latitude in a grid has specific x and y coordinates). These variables are related to spatial datasets for geo-reference sources of infections (e.g., a grid map of biological systems). Therefore, variations in symmetry of photonics systems have been managed for realization different features exciting intra-cellular topologies. These topologies of perspective photonics systems are related to spatial datasets with area source or area-source pathogenic insertions to predict the parameters of biophysical model. The parameters are developing topological indices to differentiate values of cell clusters (molecules) for high/very high power and identifying cellular graphs as uniquely possible in terms of such indices [182]-[186].

In other words, an autopoietic system has a unity function in topographically and functionally masked from the background. These closure levels are modulation processes to produce components attached in the original processes. Other means of autopoietic systems are a general principle of circular organization, which are applied in other disciplines contexts; such as ecosystems, artificial intelligence and artificial life, social sciences, linguistics, economics. In fact, autopoietic systems are applicable for a special case of a larger class of *organizationally closed* systems [167].

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