

Sustainability Modelling and Sustainability Evaluation of a Mechanical System in a Concurrent Engineering Environment: A Digraph and Matrix Approach

Authors : Anand Ankush, Wani Mohammed Farooq

Abstract : A procedure based on digraph and matrix method is developed for modelling and evaluation of sustainability of Mechanical System in a concurrent engineering environment. The sustainability parameters of a Mechanical System are identified and are called sustainability attributes. Consideration of attributes and their interrelations is rudiment in modeling and evaluation of sustainability index. Sustainability attributes of a Mechanical System are modelled in terms of sustainability digraph. The graph is represented by a one-to-one matrix for sustainability expression which is based on sustainability attributes. A variable sustainability relationship permanent matrix is defined to develop sustainability expression (VPF-t) which is also useful in comparing two systems in a concurrent environment. The sustainability index of Mechanical System is obtained from permanent of matrix by substituting the numerical values of attributes and their interrelations. A higher value of index implies better sustainability of system. The ideal value of index is obtained from matrix expression which is useful in assessing relative sustainability of a Mechanical System in a concurrent engineering environment. The procedure is not only useful for evaluation of sustainability of a Mechanical System at conceptual design stage but can also be used for design and development of systems at system design stage. A step-by-step procedure for evaluation of sustainability index is also suggested and is illustrated by means of an example.

Keywords : digraph, matrix method, mechanical system, sustainability

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