

Redundancy Component Matrix and Structural Robustness

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Abstract : We introduce the redundancy matrix that expresses clearly the geometrical/topological configuration of the structure. With the matrix, the redundancy of the structure is resolved into redundant components and assigned to each member or rigid joint. The values of the diagonal elements in the matrix indicates the importance of the corresponding members or rigid joints, and the geometrically correlations can be shown with the non-diagonal elements. If a member or rigid joint failures, reassignment of the redundant components can be calculated with the recursive method given in the paper. By combining the indexes of reliability and redundancy components, we define an index concerning the structural robustness. To further explain the properties of the redundancy matrix, we cited several examples of statically indeterminate structures, including two trusses and a rigid frame. With the examples, some simple results and the properties of the matrix are discussed. The examples also illustrate that the redundancy matrix and the relevant concepts are valuable in structural safety analysis.

Keywords : Structural Robustness, Structural Reliability, Redundancy Component, Redundancy Matrix

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