DESIGN AND OPTIMAL SYNTHESIS OF COMPLIANT MECHANISMS – AN OPTIMALITY CRITERIA APPROACH

G. ARUNKUMAR¹, S. LAKSHMI SANKAR² & S. PADMAGIRISAN³

¹Professor and Head, Department of Mechanical Engineering, Sathyabama University, Chennai, Tamil Nadu, India
²Associate Professor, Department of Mechanical Engineering, Sathyabama University, Chennai, Tamil Nadu, India
³Adjunct Faculty, Department of Mechanical Engineering, EMBRY-RIDDLE Aeronautical University, Arizona, United States

ABSTRACT

Compliant mechanisms can be viewed as a single elastic continuum and gain mobility from the deflection of flexible members, rather than links and Joints. Compliant Mechanisms are modeled using the methods of continuum solid mechanics, rather than rigid body kinematics. Structural Optimization techniques can be adopted for compliant mechanism design. The geometric structure of a compliant mechanism and the properties of the material it is made of determine its force and motion transmission capability. Design of compliant mechanisms, then becomes an inverse problem wherein, the geometry of the flexible material continuum for a given material is to be obtained for prescribed force and displacement specifications. Continuous Optimization methods are employed in solving this inverse problem. The unique feature of this design method is that, optimal solutions of the compliant mechanisms can be generated automatically to obtain desired force-deflection behavior. No decisions are made about this physical form of the compliant mechanism at the outset, except specifying the space in which it should fit. The optimization algorithm generates the best solution for a given problem specification. The solutions obtained in this manner have adequate details to generate the manufacturing information automatically, in the form of computer numerically controlled machine code, for macro devices.

KEYWORDS: Compliant Mechanisms, Topology Optimization, Optimal synthesis & Continuum Models

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