

A Fuzzy Satisfactory Optimization Method Based on Stress Analysis for a Hybrid Composite Flywheel

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Abstract : Considering the cost evaluation and the stress analysis, a fuzzy satisfactory optimization (FSO) method has been developed for a hybrid composite flywheel. To evaluate the cost, the cost coefficients of the flywheel components are obtained through calculating the weighted sum of the scores of the material manufacturability, the structure character, and the material price. To express the satisfactory degree of the energy, the cost, and the mass, the satisfactory functions are proposed by using the decline function and introducing a satisfactory coefficient. To imply the different significance of the objectives, the object weight coefficients are defined. Based on the stress analysis of composite material, the circumferential and radial stresses are considered into the optimization formulation. The simulations of the FSO method with different weight coefficients and storage energy density optimization (SEDO) method of a flywheel are contrasted. The analysis results show that the FSO method can satisfy different requirements of the designer and the FSO method with suitable weight coefficients can replace the SEDO method.

Keywords : flywheel energy storage, fuzzy, optimization, stress analysis

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