Low Cycle Fatigue Analysis of Architectured Materials: Incorporating Theory of Critical Distance with Elastoplastic Homogenization

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Abstract

Computational homogenization is an efficient tool for the analysis of architectured materials. However, standard effective quantities obtained from homogenization are insufficient for analyzing phenomena such as fatigue due to localized stress/strain concentrations. To address this issue, in the context of elastoplastic homogenization, the information of the local plastic strain in the critical region of the representative volume element is captured using the theory of critical distance for fatigue-life predictions. This theory provides an efficient method for fatigue analysis, and is introduced here for the fatigue analysis of architectured materials. Fatigue is one of the challenges in the industrial applications of such materials in presence of cyclic loading. The method, being generic, has been applied here to 2-D auxetic and 3-D kelvin lattices.

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