EFFECTIVE PROPERTIES OF PERIODIC LAMINATED CENTRO-SYMMETRIC MICROPOLAR COMPOSITES WITH NON-UNIFORM IMPERFECT CONTACT CONDITIONS

Victor Yanes[1], Reinaldo Rodríguez-Ramos[2], Yoanh Espinosa Almeyda[3], César Fidel Sánchez-Valdés[3], Hector Camacho Montes[3], José Antonio Otero[4], Federico J Sabina[5]
[1]Universidad Politécnica de Madrid, Escuela Técnica Superior de Ingeniería Aeronáutica y del Espacio, Spain. [2]Universidad de La Habana, Facultad de Matemática y Computación, Cuba. [3]Universidad Autónoma de Ciudad Juárez, Departamento de Física y Matemáticas, Instituto de Ingeniería y Tecnología, Mexico. [4]Tecnologico de Monterrey, Escuela de Ingeniería y Ciencias, Mexico. [5]Universidad Nacional Autónoma de México, Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas, Mexico.

The two-scale asymptotic homogenization method (AHM) is implemented for periodic laminated micropolar composites with centro-symmetric constituents and non-uniform imperfect interface contact conditions, i.e., tractions and coupled stress are continuous but displacements and microrotations are discontinuous across the imperfect interface. The jumps in displacement and microrotation components are assumed to be proportional, in terms of a partition of different spring-factor-type interface parameters, to their respective interface traction and coupled stress components. From AHM, the solutions for the displacement and microrotation fields are proposed as series expansions depending on a local (microscopic) variable and a global (macroscopic) variable. The local problems are solved, and the effective properties are found as a function of the constituent material properties, the imperfection parameters, and the volume fractions of the phases. Numerical results are shown and discussed for a bi-laminated micropolar composite with several interface imperfection partitions and different values of imperfection parameters. Limit cases are analyzed, such as, perfect, and uniform imperfect contact conditions. The effect of the imperfection type on the effective elastic behavior is shown.

Keywords: Asymptotic homogenization method, Centro-symmetric laminated Cosserat composite, non-uniform imperfect contact conditions

Acknowledgment:

YEA gratefully acknowledges the financial support of the Grant A1-S-37066 during the postdoctoral stay at UACJ, 2021-2022. CFSV is grateful for the support of the CONACYT Basic Science Grant A1-S-37066. FJS and RRR acknowledge the funding of PAPIIT-DGAPA-UNAM IN101822, 2022-2023. RRR thanks to the Department of Mathematics and Mechanics, IIMAS-UNAM for its support, and the funding of PREI-DGAPA-UNAM.

Presenting author's email: yoanhealmeyda1209@gmail.com