ACELAN-COMPOS Package for Finite Element Simulation of Active Composite Materials

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ABSTRACT

The ACELAN-COMPOS package is intended for computer design of two-phase active composite materials with the coupling of mechanical and electromagnetic fields. The most common class of such materials is the class of magnetoelectric (piezomagnetoelectric) composites. Other widely used examples of active composites are the piezoelectric composites consisting of a piezoelectric phase of one basic material and a piezoelectric or elastic phase of another material (possibly pores).

In order to determine the effective moduli of such composites, a comprehensive approach is used, which includes the effective moduli method, the modeling of various structures of representative volumes, and the finite element method. This technology is implemented in the currently developed package ACELAN-COMPOS. The ACELAN-COMPOS package is developed by a large number of researchers, some of whom are listed as authors of publications on ACELAN-COMPOS in recent years [1, 2].

This work describes the models of magnetoelectric composites, which take into account the size effects; the methods for creating representative volumes, based on the types of connectivity of the composite and the peculiar properties of its internal structure; and the homogenization methods and the basic units of ACELAN-COMPOS. We provide the examples of the representative volumes simulation for the granular composites, for the composites with the coupling of both phases and some other types of two-phase composite structures. The results of solving the homogenization problems for porous piezoelectric composites and for piezoelectric composites with elastic inclusions are also presented. In these calculations, the representative volume models generated in ACELAN-COMPOS were then transferred to the ANSYS finite element package, where the effective moduli of the composite were calculated. In future, the full cycle of calculations is expected to be carried out in ACELAN-COMPOS package. Future prospects for the development of the ACELAN-COMPOS package are discussed in conclusion.

REFERENCES

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