Abstract

Numerical Computation of Wave Motion through Dynamic Materials

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Received: Mon, 1 Apr 2002 09:37:31

Dynamic materials are spatio-temporal composites formed from materials which are distributed on a microscale in space and in time. These materials are of particular interest when we want to affect the influences of long wave disturbances. A dynamic disturbance on a scale much greater than the scale of a spatio-temporal microstructure will perceive this formation as a new material with its own effective properties. With spatio-temporal variability in the material constituents, we shall be able to effectively control the dynamic processes by creating effects that are unachievable through purely spatial (static) material design. For example, by appropriately controlling the design factors of a dynamic composite, it is possible to selectively screen large domains in space-time from the invasion of long wave disturbances. One is also able to eliminate the existence of the cut-off frequency in electromagnetic waveguides.

In this talk, we focus on the direct numerical simulation of wave motion through dynamic composites. Work is presented for laminated materials where the material properties are periodic and move with constant velocity. We present numerical results and the numerical and analytical challenges that arise in various scenarios.