

### **Initial boundary value problems for second order systems**

The theory of first order hyperbolic systems is very well developed. However, the theory for second order systems is less complete, especially in bounded domains where the boundary conditions play an important role. This is not surprising since there is a large number of boundary phenomena like glancing waves and complicated boundary conditions consisting of relations between time, normal and tangential derivatives.

Attempts have been made to write the second order system consisting of  $n$  equations as a first order system of differential equations. Unfortunately, the resulting first order system consists, in general, of more than  $2n$  equations which leads to many complications. Here we will use the theory of pseudo-differential equations combined with mode analysis. There are many advantages to this approach.

- 1) The reduction to first order systems of pseudo-differential equations poses no difficulty. We will obtain a system of  $2n$  equations.
- 2) We can localize the problem, I.e., we need only to study the Cauchy problem and halfplane problems with constant coefficients.
- 3) The class of problems we can treat is much wider than the usual one which is restricted to problems that can be treated by 'integration by parts'.
- 4) The relation between boundary conditions and boundary phenomena becomes much more transparent.