

The Applicability of Plate Problem Preconditioners for the Laminated Plate Problem

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Laminated plates, i. e. plates composed of several material layers, are often used in lightweight construction. Since fibre-reinforced composites are only strong in fibre direction, multiple layers with different fibre directions are combined into a laminate to account for different load cases. Our goal is to simulate such structures with FEM.

The Kirchhoff plate model with constant materials over the thickness leads to the classical plate equation, which is decoupled from the in-plane deformation of the mid-surface. In the given problem this decoupling only holds true for a symmetric laminate sequence over the thickness but not in the general asymmetric case. Here in-plane deformations can cause out-of-plane deformations and vice versa.

The resulting FE system matrix comprises membrane, plate and couple parts. A preconditioner for the conjugate gradient method is needed in order to solve the system efficiently. One simple approach for a preconditioner is to neglect the couple terms and to combine existing preconditioners for the membrane and plate problems. Our talk examines the effectiveness of this approach by the means of a spectral equivalence estimate.

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