English summary

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A parametric fracture mechanics study of the effect of a cold lap defect on fatigue strength

Mikko Heiskanen

Summary. Several finite element analyses were carried out to study the effect of local geometrical variation of weld on fatigue strength of non-load-carrying cruciform joints in as-welded condition under tensile loading. Cruciform joints can be found in many heavy industrial applications, such as in junctions of longitudinal and transverse stiffeners in welded plate girders of shipyard cranes and orthotropic plates of ships. The variables were toe radius, cold lap and flank angle. The fatigue assessment was carried out with linear-elastic fracture mechanics in plane strain and under mixed-mode $K_I - K_{II}$ conditions. The Paris crack growth law was used to predict the growth rate. An analytical model was developed and its accuracy was compared to the available experimental fatigue test results.

Key words: fatigue crack growth, finite element analysis, fracture mechanics, mixed mode fracture, welded joints

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Engineering oriented formulation for laminate lay-up optimization

André Mönicke, Harri Katajisto, Petri Kere, Markku Palanterä and Marco Perillo

Summary. The concept of elementary laminates is used to formulate the design problem for a laminated composite structure. A parameterized laminate is divided into stacks with periodic patterns of elementary laminates. With elementary laminates desired regularity for the laminate lay-ups is achieved, which is practical for multi-layer laminates. Due to the reduced design space solution time can be considerably reduced. Two laminate lay-up formulation concepts are presented and their performance is evaluated. The design problem used as a reference case involved the optimization of the stacking sequences to maximize plate buckling loads using a genetic algorithm.

Key words: laminated composites, design optimization, genetic algorithm

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Mechanical modelling of filamentary superconductors – special features and approaches

Maria Ahoranta

Summary. Superconductors lose their electrical resistivity at cryogenic temperatures. Consequently, they can be used, for example, in high field magnets. Most superconductors are sensitive to mechanical loading. Loading can cause both reversible changes in electrical properties and fracture of superconductor. Predicting the mechanical behaviour of superconductors is important, because they are typically under large electromagnetic forces and thermal stresses in applications. The mechanical modelling of conductors is challenging especially because of their composite structure and the notable temperature changes during their lifetime. In a composite conductor, the superconducting filaments are typically embedded in soft metal such as bronze, copper or silver and the conductor structure might be twisted. This article presents problems encountered in mechanical modelling of one type of filamentary superconductor and suggests approaches for modelling.

Key words: superconductors, composites