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Blast Resistance of Clamped Sandwich Beams

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A systematic design procedure has been developed for analysing the blast resistance of clamped sandwich beams. The structural response of the sandwich beam is split into 3 sequential steps: stage I is the 1D fluid-structure interaction problem during the blast loading event, and results in a uniform velocity of the outer face sheet; during stage II the core crushes and the velocities of the faces and core become equalised by momentum sharing; stage III is the retardation phase over which the beam is brought to rest by plastic bending and stretching. The 3-stage analytical procedure is used to obtain the dynamic response of a clamped sandwich beam to an imposed impulse.Performance charts for a wide range of sandwich core topologies are constructed for both air and water blast, with the monolithic beam taken as the reference case. These performance charts are used to determine the optimal geometry to maximise blast resistance for a given mass of sandwich beam. For the case of water blast, an order of magnitude improvement in blast resistance is achieved by employing sandwich construction, with the diamond-celled core providing the best blast performance. However, in air blast, sandwich construction gives only a moderate gain in blast resistance compared to monolithic construction.

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