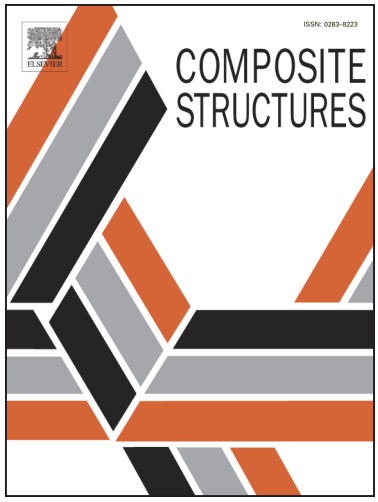

A review of impact testing on marine composite materials, Part III: Damage tolerance and durability

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A review of impact testing on marine composite materials, Part III: Damage tolerance and durability

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Abstract: Composite materials are now used throughout the marine industry but their susceptibility to impact events is still an unresolved problem. The complex nature of the problem in terms of the distinct material and impact event parameters specific to marine applications has been discussed in parts I & II. Tolerance to impact damage is usually of greater concern than resistance to a catastrophic failure and hence the compression, flexural and other loading tolerance of marine composites to impact is reviewed here. Since in-service impacts will occur in the aggressive marine environment, studies on water absorption, temperature and repeated impact effects have also been discussed. Together with parts II and III, this paper gives a comprehensive review of 'marine impact on marine composites', providing a valuable resource for the marine industry and research fields.

Keywords: Impact; Marine; Testing; Damage Tolerance; Durability; Water absorption; Temperature

1. Introduction

Laminated fibre-reinforced composite materials are commonly used in many areas of the marine industry, mainly due to their resistance to the aggressive marine environment, ease of fabrication and potential high specific material properties. However damage is a known potential weakness of these materials when subjected to low-velocity impacts (LVI) with solid objects, as commonly encountered in a marine environment due to such events as collisions with floating debris, other craft, docks, and during production.

In Part I of the review [1] research on the impact on composite materials in general has been summarised, in-service 'marine impact' events described, comparisons of composites materials with other material systems were made, and the complexity of the problem discussed. In part II [2] concerned impact damage and the effects of both impact event and material parameters on impact behaviour.

Although for an extreme impact event the integrity and hence the impact resistance of the laminate to perforation is crucial to avoid potential loss of the vessel or structure, more often than not it is the reduction in structural properties after an impact event that is most dangerous, and hence their tolerance to impact damage is extremely important. Also, the marine environment is an aggressive one, both in terms of exposure to salt water and harsh temperatures, and in terms of a lifetime of dynamic loadings. Hence, marine laminates must be sufficiently durable to maintain their impact properties and so this third part of the review concerns the research on the damage tolerance and durability of marine composites.