A NOTE ON THE DYNAMICS OF A VLASOV BEAM.

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This paper is concerned with coupled bending and twisting of thin-walled beams. The problem at which it is ultimately directed is that of antisymmetric oscillations of a ship's hull due to wave excitation. Hitherto, the linear dynamics of a beam-like ship moving in oblique seas has been tackled using an adaptation of the Timoshenko Beam theory, with due allowance made for warping if necessary [1,2].

In all its generality, coupled bending and twisting of a non-uniform beam is very difficult to analyse and there can be no suggestion that the theory referred to is anything better than an attempted approximation. Since antisymmetric responses of certain vessels (particularly container ships) are of considerable importance, it is necessary to ask what can be done about this unsatisfactory state of affairs.

It seems reasonable to start with the coupled motions of uniform beams, and to address such difficulties as hull specification and allowance for nonuniformity later. If this standpoint is adopted there are two approaches to consider:
    (a) Can the modified Timoshenko beam theory be improved upon, either by
       further modification or by adopting a different theoretical approach?
    (b) To what extent are results obtained from the modified Timoshenko beam
       theory confirmed or denied by experiments?
It is the writers' intention to tackle both of these questions and the purpose of this paper is to take up the first of them. The results of the theoretical study can then be employed to make alternative predictions which may be compared with those of the existing theory; both sets of predictions can then be compared with measured results.

The theory to be used is that of the Vlasov Beam [3], which has received considerable attention in (static) structural analysis. It will be shown that, like the Timoshenko beam it can be modified for the dynamics of coupled bending and twisting. The purpose of this paper, then, is to
    (i)   explain briefly the nature of the Vlasov beam and how the theory has
       been used
    (ii) adapt the relevant theory for dynamical purposes and thence to derive
       appropriate orthogonality conditions
    (iii) compare predicted principal modes and natural frequencies for a
       a simple free-free beam of uniform channel section with those of the
       modified Timoshenko Beam theory.

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