An Introduction to the Session on *"Large amplitude rolling motion and nonlinear ship dynamics"* and a proposal for the establishment of an international group

FOR THE STUDY OF NONLINEAR PHENOMENA IN THE DYNAMIC BEHAVIOUR OF SHIPS AND OF OTHER MARINE STRUCTURES

by

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In recent years we have witnessed a significant progress in the understanding of complex nonlinear phenomena of dynamic behaviour of ships. Significant new insights concerning mechanisms generating instability in various motions directions have been achieved and new avenues towards the development of rigorous, yet useful, measures for ship design or operation have been opened. Some of these issues will be discussed during the current Workshop. Such a progress would not have been possible without the effective use of a powerful set of concepts, methods and techniques which collectively comprise what has become customary to call a "nonlinear dynamical systems' approach". This approach rests equally on theory and experiment, has a clearly interdisciplinary nature and has found already application in a wide variety of engineering problems. Yet, despite its strong scientific footing, well proven importance and forged connection with application, when considered against a conventional naval architectural background it appears still almost exotic, and privilege of a small group of specialists.

There is a clear need for a coordinated action at international level engaging the several active researchers of the field, which will promote the wider and deeper use of the nonlinear dynamics' ideas and tools in the education and training, the research and the practice of naval architecture and related disciplines. This can be facilitated with the formation of *an international group on nonlinear ship dynamics* which will be working towards objectives such as, but not restricted to, the following:

- Promoting the use of nonlinear dynamics ideas in a wider context within the marine technology research community.
- Reporting about the state-of-the-art and identifying new problems where such ideas can find fruitful application.
- Organising dedicated meetings and acting as a high-level and authoritative scientific forum for the discussion of practical safety measures related with the occurrence of nonlinear phenomena.
- Facilitating joint research initiatives at international level and also the exchange of visits between researchers.
- Liasing with similar groups in other engineering fields as well as with international research or professional maritime organisations.
- Undertaking initiatives for the introduction of the teaching of nonlinear dynamics in the undergraduate and postgraduate curricula of departments of naval architecture or of similar disciplines.
- Promoting the familiarisation of practising naval architects with the basic concepts through publication and the organisation of seminars.

Some of the recent initiatives which this group could build further upon are:

- The workshop on nonlinear ship dynamics which was "run" successfully in the last two STAB Conferences (in Varna & in Launceston),
- the sessions dedicated to Nonlinear Dynamics in the context of the series of international workshops on the Stability and Operational Safety of Ships (in Crete, in Newfoundland and the current one in Trieste) which have attracted in all cases first-class participation,
- the recent publication of a special issue in the Philosophical Transactions of the Royal Society on *the nonlinear dynamics of ships*.

As it is obvious, several detailed issues need to be discussed and resolved that will allow the formation of the group to be successful. Without attempting to pre-judge the debate which is hoped to take place during the preliminary meeting of Nonlinear Dynamics on the 11th of September, some possible matters for discussion could be:

- the specific structure of the group,
- possibilities of representation in international organisations,
- initiatives that could be undertaken in the immediate future.