Depth-limited wave breaking dissipation in a potential flow code

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Abstract:
Simulation of waves beyond the breaking point in a fully non-linear potential flow model (e.g. Raoult et al. [1]) is considered with a semi-empirical dissipation term that requires correctly determining the breaking onset and estimating the energy dissipation rate. A kinematic breaking criterion, similar to those found recently to be practical for arbitrary water depth (e.g. Derakthi et al. [2]), is applied here. The criterion is based on U/C, the ratio of the free surface water velocity to the wave phase speed. To estimate the wave breaking strength in shallow water, previous work by Svendsen et al. [3] that continues to be used and developed (e.g. Grilli et al. [4]), has shown that a hydraulic jump model can provide a reliable approach for spilling shallow water breakers. Alternatively, Derakthi et al. [5] proposed a parameterization for the breaking strength in deep and intermediate water depending on the rate of change of U/C. Here, a range of depth-limited wave breaking cases for regular and irregular waves are considered and validated with experimental measurements, and values for the rate of change of U/C and the breaking strength are calculated for shallow water cases. Current work includes exploring if and how these different parameterizations may be combined to develop a unified approach to be applied in fully nonlinear potential flow models.

References

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