Hyperfast Surface Wave Modeling in the Coastal Zone

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I discuss new numerical wave modeling techniques that allow for the construction of a new class of coastal zone wave models. The models are based upon techniques of algebraic geometry, topology and differential geometry that effectively transform the water wave equations of motion to a fully uncoupled set of operations which can be computed in parallel fashion on multicore computers. These perfectly parallel codes are also found to run about one hundred time faster than conventional spectral codes (those due to West and Yue) on a single core. The combined result is a code that runs over a million times faster than spectral codes on a supercomputer with 100,000 cores. I discuss the simplest of this new class of models and give a number of examples of coastal zone situations of scientific and engineering interest.