

Longuet-Higgins, Michael

**A close, one-term approximation to the highest Stokes wave on deep water
(Joint work with RCT Rainey)**

The accurate calculation of nonlinear surface waves generally requires a complicated algorithm. It is sometimes useful for ocean engineers to have a simple, approximate expression for the surface profile and particle velocities in a non-linear wave of maximum amplitude. Previous expressions of this kind have usually been accurate to within a few percent. In this talk we draw attention to a startlingly accurate, one-term approximation to the highest Stokes wave in deep water, namely

$$y/L = A \cosh(x/L)$$

x and y being horizontal and vertical coordinates, L the wavelength and $A = (\sqrt{3} \sinh 1/2)^{-1} = 1.1080$.

This determines the wave steepness H/L as 0.14140, with a proportional error of less than 0.3 percent, ten times closer than previous expressions. The entire surface profile is accurate to within 0.7 percent. The corresponding phase-speed is accurate to within 0.2 percent, and the particle velocities may be found by a straightforward numerical integration. The theoretical basis for the above expression will be described, and it will be shown that this type of approximation cannot be made exact by the introduction of further parameters. [Paper to appear in *Ocean Engineering*].

Abstract of talk given at ICMS Workshop on Rogue Waves December 2005.
www.icms.org.uk