On periodic solutions of a model equation for surface waves of moderate amplitude in shallow water

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The work which will be presented is mainly on a nonlinear evolution equation for surface waves of moderate amplitude in shallow water given below:

$$(1)\quad u_t+u_x+\frac{3}{2}\varepsilon uu_x-\frac{3}{8}\varepsilon^2u^2u_x+\frac{3}{16}\varepsilon^3u^3u_x+\frac{\mu}{12}(u_{xxx}-u_{xxt})+\frac{7\varepsilon}{24}\mu(uu_{xxx}+2u_xu_{xx})=0,\quad x\in R,\ t>0.$$

Here $u(x,t)$ is the free surface elevation and ε and μ represent the amplitude and shallowness parameters, respectively. Solutions of the Cauchy problem corresponding to (1) which are spatially periodic of period 1 are investigated. Local well-posedness is attained by an approach due to Kato which is based on semigroup theory for quasi-linear equations. Moreover, it is shown that singularities for the model equation can occur only in the form of wave breaking, in particular surging breakers. This work has been supported by The Scientific and Technological Research Council of Turkey (TUBITAK) under International Postdoctoral Research Scholarship Programme.

References

[1] *A. Constantin*: Nonlinear water waves with applications to wave-current interactions and tsunamis. CBMS-NSF Regional Conference Series in Applied Mathematics 81, SIAM (Philadephia), 2011.

[2] *A. Constantin, D. Lannes*: The hydrodynamical relevance of the Camassa-Holm and Degasperis-Procesi equations. Arch. Ration. Mech. Anal. *192* (2009), 165–186.

[3] *T. Kato*: Quasi-linear equations of evolution, with applications to partial differential equations. Spectral Theor. differ. Equat., Proc. Symp. Dundee 1974, Lect. Notes Math. 448, Springer-Verlag, Berlin, 1975, 25–70 pp.