

Universal Equations, Integrability and Applications

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Abstract

Universal equations such as the nonlinear Schrodinger (NLS) and three wave interactions equations (3WI) arise under general conditions. As such they occur in many physical problems. In addition these equations are integrable. In the integrability scheme the NLS equation is a special case of a coupled second order system and the 3WI system is a special case of a coupled sixth order system. Remarkably these more general systems are also universal and integrable and have reductions to novel nonlocal equations such as the PT symmetric NLS equation and reverse space time 3WI system. The coupled sixth order system was recently derived in water waves in finite depth. In the case of the classical 3WI system only deep water results appear to have been previously known.