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**A NEW CONSERVATIVE FOURTH-ORDER ACCURATE
DIFFERENCE SCHEME FOR THE NONLINEAR
SCHRÖDINGER EQUATION WITH WAVE OPERATOR**

SAMIRA LABIDI

ABSTRACT. A high-order difference scheme for the nonlinear Schrödinger equation with wave operator is presented. The conservative property and a priori estimates for the numerical solution are derived. Existence of solutions is shown using a variant of Brouwer fixed point theorem. The unconditional stability as well as uniqueness of the difference scheme are also discussed in detail. The convergent order in maximum norm is two in temporal direction and four in spatial direction. Some numerical experiments are reported to confirm the advantages of the proposed difference scheme by comparing with other existing recent methods available in the literature.

FACULTÉ DES SCIENCES DE BIZERTE, UNIVERSITÉ DE CARTHAGE, TUNISIA.

E-mail address: labidisamira34@gmail.com