

## POSITIVE PERIODIC SOLUTIONS FOR THE NONLINEAR WAVE EQUATION

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*Abstract.* In this paper we prove that nonlinear wave equation

$$u_{tt} - \Delta u = f(t, x, u, u_t, u_x)$$

has unique positive solution  $u(t, x)$  which is  $\omega$ -periodic with respect to the time variable  $t$ . The period  $\omega > 0$  is arbitrarily chosen and fixed.

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### REFERENCES

- [1] B. BIONDI, G. PALACHARLA, *3-D-prestack migration of common-azimuth data*, Geophysics, **61**, 6 (1996), 1822–1842.
- [2] H. BREZIS, *Periodic solutions of nonlinear vibrating strings and duality principles*, Bull. Amer. Math. Soc. (NS), **8**, 3 (1983), 409–426.
- [3] S. GEORGIEV, *Positive periodic solutions for the Korteweg de Vries equation*, Electron. J. Differ. Equ., **2007**, 49 (2007), 13p.
- [4] S. GEORGIEV, *Positive periodic solutions for the nonlinear parabolic equation*, Far East J. Dyn. Syst., **9**, 3 (2007), 455–512.
- [5] S. GEORGIEV, *On the integrating seismic facies and petro-acoustic modeling*, (in preparation)
- [6] M. KRASNOSEL'SKII, P. ZABREIKO, *Geometrical methods of nonlinear analysis*, A Series of Comprehensive studies in Mathematics 263, Springer-Verlag, Berlin-Heidelberg-New York-Tokio, 1984.
- [7] M. K. KWONG, *On Karsnoselskii's cone fixed point theorem*, Fixed Point Theory Appl., 2008, Article ID 164537, (2008), 18p.
- [8] R. PYKE, M. SIGAL, *Nonlinear wave equations: constraints on periods and exponential bounds for periodic solutions*, Duke Mathematical Journal, **88** (1997), 133–180.
- [9] P. RABINOWITZ, *Periodic solutions of nonlinear partial differential equations*, Comm. Pure Appl. Math., **20** (1967), 145–205.
- [10] R. STOLT, A. BENSON, *Seismic migration-theory and practice*, Geophysical Press, London-Amsterdam, 1986.
- [11] O. VEJVODA, *Periodic solutions of linear and weakly nonlinear wave equation in one dimension, I*, Czech. Math. J., **14** (1964), 341–382.
- [12] J. XIAOFENG, H. TIANYUE, W. RUNQIU, *A meshless method for acoustic and elastic modeling*, Appl. Geophysics, **2**, 1 (2005).