■ **TACKSUN JUNG** Department of Mathematics, Kunsan National University, Kunsan 573-701, Korea, email: tsjung@kunsan.ac.kr, **Q-HEUNG CHOI** Department of Mathematics Education, Inha University, Incheon 402-751, Korea, email: qheung@inha.ac.kr

WEAK SOLUTIONS FOR THE SINGULAR POTENTIAL WAVE SYSTEM

Abstract

In this paper we investigate the multiplicity of the solutions for a class of the system of the nonlinear wave equations:

$$U_{tt} - U_{xx} = G_U(x,t,U) \qquad \text{in } \left(-\frac{\pi}{2}, \frac{\pi}{2}\right) \times R,$$

$$u_i(\pm\frac{\pi}{2}, t) = 0, \quad u_i(x,t) = u_i(-x,t) = u_i(x,-t) = u_i(x, t+\pi), \quad i = 1, \ldots, n,$$

where $U = (u_1, \ldots, u_n)$, $U_{tt} - U_{xx} = ((u_1)_{tt} - (u_1)_{xx}, \cdots, (u_n)_{tt} - (u_n)_{xx})$, $G \in C^2([-\frac{\pi}{2}, \frac{\pi}{2}] \times R^1 \times D, R^1)$ and G_U is the gradient of G. We assume that G satisfies the following conditions:
$(G1)$ There exists $R_0 > 0$ such that

$$\sup\{|G(x,t,U)| + \|\text{grad}_U G(x,t,U)\|_{R^n}| \ (x,t,U) \in [-\frac{\pi}{2}, \frac{\pi}{2}] \times R^1 \times (R^n \backslash B_{R_0})\} < +\infty.$$

$(G2)$ There is a neighborhood Z of C in R^n such that

$$G(x,t,U) \geq \frac{A}{d^2(U,C)} \quad \text{for} \quad (x,t,U) \in (-\frac{\pi}{2}, \frac{\pi}{2}) \times R \times Z,$$

where D is an open subset in R^n with compact complement $C = R^n \backslash D$, $n \geq 2$.

1.1 Assume that the nonlinear term G satisfies the conditions $(G1) - (G2)$. Then the system has at least one nontrivial weak solution.

Bibliography

[1] Benci, V. and Rabinowitz, P.H., *Critical point theorems for indefinite functionals*, Inventions Math. vol. 52, 241-273(1979).

[2] Choi, Q.H. and Jung, T., *Multiple periodic solutions of a semilinear wave equation at double external resonances*, Communications in Applied Analysis vol. 3, No. 1, 73-84 (1999).

[3] Choi, Q.H. and Jung, T., *An application of a variational reduction method to a nonlinear wave equation*, J. Differential Equations vol. 7, 390-410(1995).