

**Test function method for blow-up phenomena  
of semilinear wave equations and their weakly  
coupled systems**

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In this talk we consider the wave equations with power type nonlinearities including time-derivatives of unknown functions and their weakly coupled systems. We propose a framework of test function method and give a simple proof of the derivation of sharp upper bound of lifespan of solutions to nonlinear wave equations and their systems. We point out that for respective critical case, we use a family of self-similar solution to the standard wave equation including Gauss's hypergeometric functions which are originally introduced by Zhou (1992). However, our framework is much simpler than that. As a consequence, we found new  $(p, q)$ -curve for the system  $\partial_t^2 u - \Delta u = |v|^q, \partial_t^2 v - \Delta v = |\partial_t u|^p$  and lifespan estimate for small solutions for new region.