Strichartz estimates for the Germain-Lagrange equation with nonlinear memory

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Abstract

We apply linear Strichartz estimates [CZ] to study the local existence of the solution to

$$\begin{cases} u_{tt} + \Delta^2 u = c_\gamma \int_0^t (t-s)^{-\gamma} |u(s,x)|^p \, ds \quad t \geq 0, \ x \in \mathbb{R}^n, \\ u(0,x) = u_0(x), \\ u_t(0,x) = u_1(x), \end{cases}$$

where $\gamma \in (0,1)$ and $c_\gamma > 0$. The right-hand side represents a nonlinear memory term, in particular a fractional integral of $|u|^p$ for a suitable choice of c_γ. For $n \geq 5$, $s \in [0,2]$, and $\gamma \in (1/2, 1)$, we find the local existence of the H^s solution in the sub-critical range

$$1 + \frac{4}{n} \leq p < 1 + \frac{4(3-\gamma)}{n-2s},$$

provided that $u_0 \in H^s$ and $u_1 \in \dot{H}^{s-2} \cap \dot{H}^{-2}$. At the limit $\gamma \to 1$, we may replace the right-hand side by $|u(t,x)|^p$. In this latter case, we may also prove the global existence of the solution into $\dot{H}^s$ in the critical case $p = 1 + 8/(n-2s)$.

This is a joint paper with Sandra Lucente from University of Bari.

References

[CZ] Cordero E., Zucco D., *Strichartz estimates for the vibrating plate equation*, J. Evol. Equ. **11** (2011), 827-845.

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