

A Uniqueness Condition for the Polyharmonic Equation in Free Space¹

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Abstract

Consider the polyharmonic wave equation $\partial_t^2 u + (-\Delta)^m u = f$ in $\mathbb{R}^n \times [0, \infty)$ with time-independent right-hand side. We study the asymptotic behaviour of $u(x, t)$ as $t \rightarrow \infty$ and show that $u(x, t)$ either converges or increases with order t^α or $\ln t$ as $t \rightarrow \infty$. In the first case we study the limit $u_0(x) := \lim_{t \rightarrow \infty} u(x, t)$ and give a uniqueness condition that characterizes u_0 among the solutions of the polyharmonic equation $(-\Delta)^m u = f$ in \mathbb{R}^n . Furthermore we prove in the case $2m \geq n$ that the polyharmonic equation has a solution satisfying the uniqueness condition if and only if f is orthogonal to certain solutions of the homogenous polyharmonic equation.

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