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On some mixed problems for fourth order hyperbolic equations

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§1. Introduction and statement of result

We consider some mixed problems for fourth order hyperbolic equations. Let S be a smooth and compact hypersurface in R^n $(n\geq 2)$ and Ω be the interior or exterior of S. Let

$$\text{(E)}\qquad Lu+Bu=\left(\frac{\partial^4}{\partial t^4}+(a_1+a_2+a_3)\frac{\partial^2}{\partial t^2}+a_3a_1\right)u+B\left(x,t,\frac{\partial}{\partial t},D\right)u$$
$$=f(x,t)$$

Here $a_k(k=1,2,3)$ are the following operators:

$$(1.1)\qquad a_k=-\sum_{i,j}^{n}\frac{\partial}{\partial x_i}\left(a_{k,ij}(x)\frac{\partial}{\partial x_j}\right)+b_k(x,D).$$
$$a_{k,ij}(x)=a_{k,ji}(x)$$

are real,

$$\sum_{ij}^{n}a_{k,ij}(x)\xi_i\xi_j\geq\delta|\xi|^2,\quad(\delta>0)$$

for every $(x,\xi)\in\Omega\times R^n$ $(k=1,2,3)$. B denotes an arbitrary third order differential operator. b_k are first order operators. Let us assume that all coefficients are sufficiently differentiable and bounded in $\overline{\Omega}$ or in $\overline{\Omega}\times(0,\infty)$. Recently S. Mizohata treated mixed problems for the equations of the form

$$L=\prod_{i=1}^{m}\left(\frac{\partial^2}{\partial t^2}+c_i(x)a(x,D)\right)+B_{2m-1},$$