Controllability of the Korteweg-de Vries equation on
a star-shaped network

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Abstract

Control theory has an important place in different scientific disciplines. This allows
the study of certain properties of mathematical models that describe physical
phenomena. A large part of these models use different types of partial differential
equations being of interest to us systems of coupled equations from an applied
perspective.

In this talk the Korteweg-de Vries equation will be presented in a star-shaped
network. This system is formed by \( N \) Korteweg-de Vries equations coupled by
the boundary conditions. In the literature (see[1]), there is a recent result proving
the exact controllability of this system by using \((N+1)\) controls where \( N \) controls
act on the external nodes of the network and the other one is a central control.
It will be shown that the system is exactly controllable with fewer controls. The
system is described by the following equations:

\[
\begin{align*}
\sum_{j=1}^{N} \frac{\partial^2 u_j}{\partial x^2}(t,0) &= -\alpha u_1(t,0) - \frac{N}{3} (u_1(t,0))^2 + g(t), \quad \forall t > 0, j = 1, \ldots, N, \\
\partial_x u_j(t,l_j) &= g_j(t), \quad \forall t > 0, j = 1, \ldots, N, \\
\partial_x u_j(t,0) &= 0, \quad \forall t > 0, j = 1, \ldots, N, \\
u_j(0,x) &= u_j^0(x), \quad \forall x \in (0,l_j), \forall t > 0, j = 1, \ldots, N. 
\end{align*}
\]

(1)

We use the duality and multiplier method to study the controllability of the
linearized system around the origin and the fixed point theory to include nonlin-
erarities.

References

[1] K. Ammari, E. Crépeau. Feedback stabilization and boundary controllability of
the Korteweg-de Vries equation on a star-shaped network. SIAM J. Control Optim