

# Influencia de perturbaciones mecánicas y térmicas sobre la transferencia de calor en cavidad diferencialmente calentada, determinación mediante simulación numérica directa

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## Abstract

La convección natural es un mecanismo de transferencia de calor donde el movimiento del fluido es inducido por la presencia de una fuerza de cuerpo como la gravedad. Las fluctuaciones en el campo de temperatura al interior del fluido producen variaciones locales en la densidad, las cuales en presencia de un campo de fuerza generan fuerzas de flotación que desestabilizan el fluido.

El estudio de la convección natural confinada al interior de cavidades, iniciado por Batchelor en 1954, ha sido motivo de múltiples investigaciones tanto teórico como experimental y numérico las últimas décadas, siendo clasificados en tres categorías principales: cavidades donde el flujo es inducido por generación de calor interna, cavidades calentadas por la cara inferior (Configuración de Rayleigh-Bénard) y aquellas calentadas por las paredes verticales, configuración conocida como “Cavidad Diferencialmente Calentada”.

El creciente interés por estudiar este fenómeno radica en su importancia tanto en flujos naturales como en el ámbito industrial, donde destacan por ejemplo la climatización de habitaciones, enfriamiento de equipos electrónicos, el diseño de reactores nucleares o colectores solares. Es por este motivo que resulta interesante poder controlar o modificar la transferencia de calor en este tipo de configuración mediante el uso de actuadores mecánicos o térmicos apropiados.

El régimen del flujo esta determinado principalmente por tres factores: la geometría de la cavidad, la naturaleza del fluido y por el número de Rayleigh  $\left(Ra_H = \frac{g\beta\Delta TH^3}{\nu\alpha}\right)$ , el mecanismo de transición entre distintos regímenes producto de sucesivas bifurcaciones que ocurren a ciertos valores críticos ( $Ra_{Crit}$ ) tiene un efecto directo sobre la transferencia de calor que atraviesa la cavidad.

La excitación mediante perturbaciones mecánicas o térmicas sobre las zonas de inestabilidad convectivas que se desarrollan en las capas límites permiten modificar los valores críticos de Rayleigh donde se presentan dichas bifurcaciones, gatillándolas de manera anticipada incrementando la transferencia de calor o bien retrasándolas generando el efecto contrario.

*Keywords:* Transferencia de calor, Convección Natural, Cavidad Diferencialmente Calentada, Simulación Numérica Directa

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