多相流和计算流体力学

气液两相流电导波动信号的混沌递归特性分析

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摘要   通过对典型的Lorenz混沌方程和Logistic映射的考察,研究了相空间嵌入参数(嵌入维数、延迟时间和阈值)对递归分析结果的影响。研究结果表明:递归分析对嵌入维数与延迟时间的依赖性不强,嵌入维数与延迟时间变化只是改变递归率数值大小,而不改变递归结构性质;同样,阈值大小选择直接影响递归点数的多少,而不会改变递归结构性质。最后采用递归分析方法对垂直上升管中气液两相流流型进行了表征,研究结果表明,递归结构图可以较好地反映流型演化特征,且递归特征量随气相表观流速变化敏感,为气液两相流流型辨识提供了有用的特征挖掘量。
关键词   两相流   流型   递归结构   递归定量
分类号

Chaotic recurrence characteristics analysis of conductance fluctuating signal of gas/liquid two-phase flow

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Abstract

  This paper investigated the influence of phase space embedding parameters,which are embedding dimension,time delay and threshold,on the recurrence analysis based on the classical Lorenz chaotic equation and Logistic mapping.The study results showed that the recurrence analysis was not significantly dependent on the embedding parameters,and the variations of embedding dimension and time delay only led to changes of recurrence rate and did not change the texture of recurrence plot.In the same way,the threshold could directly affect the amount of recurrence points and did not change the texture of recurrence plot.Finally the recurrence analysis method was used to characterize flow patterns of gas-liquid two-phase flow in a vertical upward pipe,the characterization result showed that the recurrence plot could well reflect the evolution characteristics of flow pattern,and the recurrence characteristics quantities were sensitive to the variations of superficial gas velocity and provided the useful characteristics mining quantities for flow pattern identification of gas/liquid two-phase flow.

Key words   two-phase flow   flow pattern   recurrence texture   recurrence quantification

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