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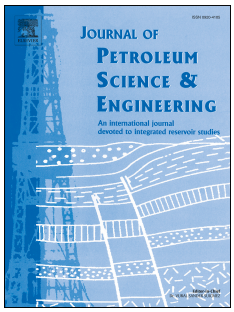

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Numerical modelling of hydrogen-natural gas mixtures flows in looped networks

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Abstract

This article concerns the numerical analysis of high pressure hydrogen-natural gas mixtures flows in pipeline networks during steady and transient states. The considered fluid is an homogeneous mixture of hydrogen and natural gas. An isentropic process is admitted for both components and under such assumption the density of the binary gas mixture is defined. The steady state was studied by the use of Hardy Cross method .The numerical simulation of the transient regime was performed by solving the conservation equations, for one-dimensional isentropic compressible flow, using the characteristics method of specified time intervals. The obtained results have proved the efficiency of the characteristics method compared to other numerical techniques. The numerical obtained results have shown that, during transients, pressure oscillations for hydrogen and hydrogen-natural gas mixtures are higher compared to those for natural gas.

Keywords: hydrogen; natural gas; transient flow; looped network; Hardy Cross method; method of characteristics

1. Introduction

Hydrogen is foreseen as an important and reliable energy carrier in the future sustainable energy society. During the transition phase towards a full development of hydrogen market, the use of the actual natural gas pipeline networks to pump hydrogen mixed with natural gas seems to be a good economic solution [1]. For the permanent regime, mixing hydrogen with natural gas has no effect on the mechanical resistance of pipelines designed to transport pure natural gas. Indeed, burst tests under a constant pressure have shown that mixing