二維無閥式阻抗幫浦的流體力學研究

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摘 要

本研究我們建構了一二維無閥阻抗式幫浦，此幫浦是由一矩型硬管上部一端覆蓋一段彈性材料以形成不對稱的聲波組抗。此矩型管兩端各自連結壓克力圓形蓄水庫(Reservoir)，以形成一開迴路，蓄水庫中的水位變化可用來觀察水頭的大小。藉由一垂直式的機電壓縮機構以一固定頻率壓縮彈性材料部份，如此將產生入射波與反射波的交互作用，因而形成一淨壓力梯度，驅動流體。這種現象就是習知的利鮑現象(Liebau phenomenon)。 研究中，我們也同時建構了一圓形截面的幫浦，此幫浦與矩型幫浦擁有相同的水力直徑(Hydraulic diameter)。藉由改變壓縮的位置、頻率及壓縮量來觀察水頭及流率的變化。並比較矩型幫浦的汲水表現。 最後為了解無閥汲水現象，我們建構了一簡單的二維波動數學模型，此模型推導出的流率隨時間的變化，不論在定性或定量上均與實驗吻合，此模型成功地解釋了無閥汲水的物理機制。

關鍵詞 : 二維無閥門，阻抗幫浦，彈性軟管，波的傳遞。

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