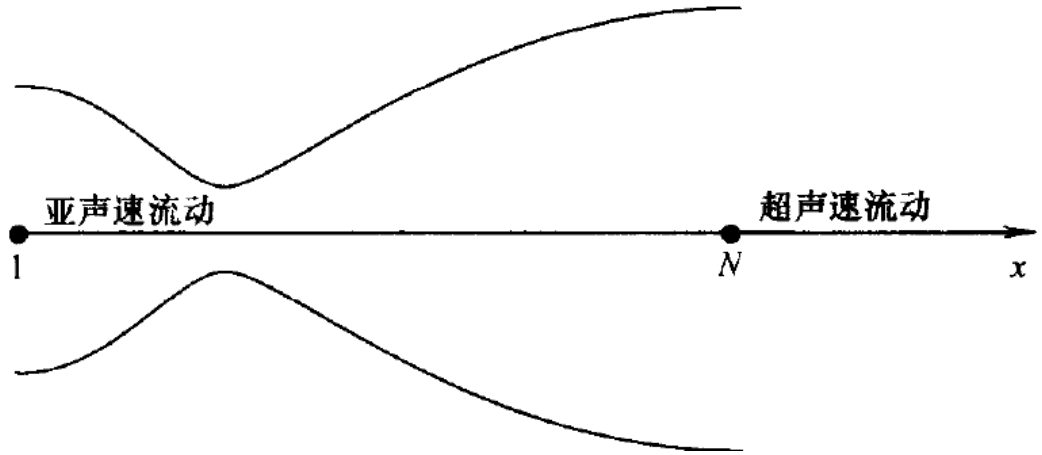
HW02(03-19)

拟一维喷管(nozzle)流动



非定常拟一维喷管(nozzle)流动的控制方程组

- 基于控制体(参见右图)推导下列方程组:

连续性方程:

$$\frac{\partial(\rho A)}{\partial t}+\rho A\frac{\partial V}{\partial x}+\rho V\frac{\partial A}{\partial x}+VA\frac{\partial \rho}{\partial x}=0$$

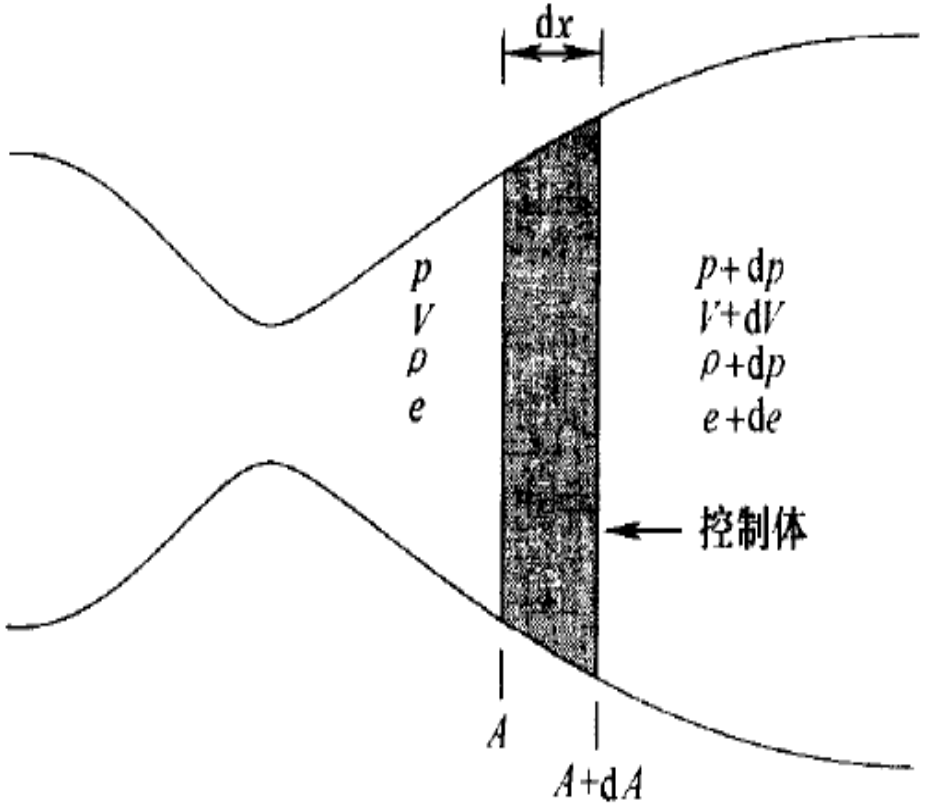
动量方程:

$$\rho\frac{\partial V}{\partial t}+\rho V\frac{\partial V}{\partial x}=-R\left(\rho\frac{\partial T}{\partial x}+T\frac{\partial \rho}{\partial x}\right)$$

能量方程:

$$\rho c_v\frac{\partial T}{\partial t}+\rho V c_v\frac{\partial T}{\partial x}=-\rho RT\left[\frac{\partial V}{\partial x}+V\frac{\partial(\ln A)}{\partial x}\right]$$

$$p=\rho RT$$



推导非定常拟一维流动控制方程组所用控制体(阴影区)

J.D. Anderson, Computational Fluid Dynamics: The Basics with Applications, McGraw-Hill,1995, 第7章.