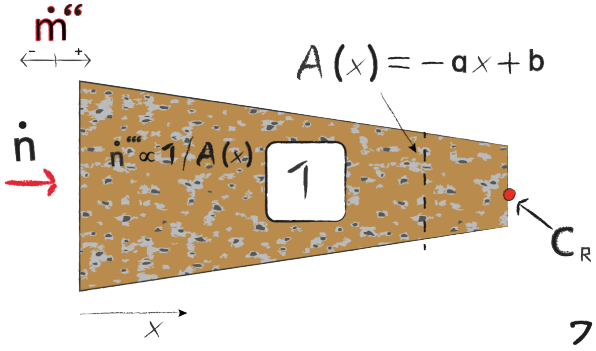
Mass Flux Profile: Task 7



The image describes a body with cross section area decreasing linearly towards the right and a volumetric mass source proportional to $\frac{1}{A(x)}$. At the left boundary there is given a positive mass flux.

At the left boundary an imposed mass flux is given to be positive, which it is for the entire body accordingly. It is obvious that specific mass flux increases towards the right due to the mass source and decreasing area. To further figure out the profile it is convenient to set up a mass balance for an infinitesimal slice of the body in x-direction.

$$\dot{m}'''(x)A(x) = \frac{\mathrm{d}\dot{m}}{\mathrm{d}x}$$

1

As it is asked for specific mass flux, mass flux is expressed by $\dot{m}''A(x)$.

$$\dot{m}'''(x)A(x) = [\dot{m}''A(x)]\frac{\mathrm{d}}{\mathrm{d}x}$$

Since the mass source is proportional to $\frac{1}{A(x)}$ the left term is considered to be constant.

$$C = \frac{\mathrm{d}\dot{m}''}{\mathrm{d}x}A(x) + \dot{m}''(-a)$$

In order to meet the equation, mass flux must be increasing with the profile getting steeper towards the right.