CV ANALYSIS - CONSERVATION OF MASS: EXAMPLE PROBLEM
FLOW ON A MOVING BELT

A belt driven at speed $U$ by a pair of rollers generates a linear velocity profile in a gas within a two-dimensional channel of height $h$.

The channel is fed with gas through an attached, two-dimensional channel of height $H$. Since the feed channel is very long, the flow can be considered fully developed and its velocity profile parabolic:

\[ u_1(y_1) = u_{\text{max}} \left[ 1 - 4 \left( \frac{y_1}{H} \right)^2 \right], \]

Where $u_{\text{max}}$ is the maximum speed attained at the center of the channel.

Determine the expression for $u_{\text{max}}$ in terms of $H$, $h$ and $U$.

1- Choice of the CV (and selection of appropriate coordinate systems)
2- General expression of the governing equation

3- Assumptions

A1:

A2:

4- Reduced governing equation

5- Study of the fluxes across the CS

Flux across the entrance

Flux across the exit

6- Solution to the governing equation