

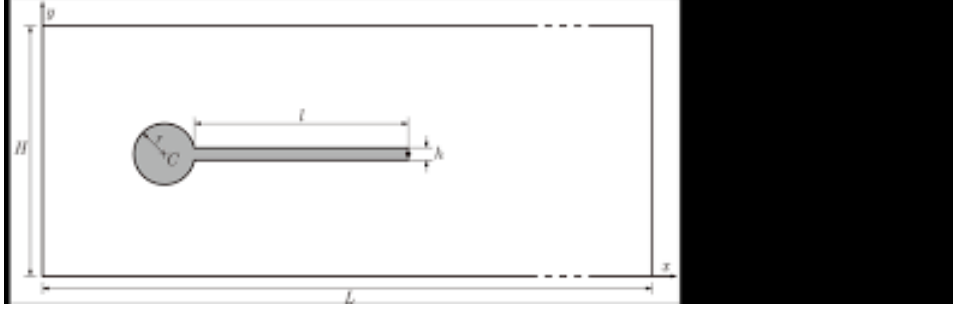
# Benchmark

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Day Month Year

## Problem Defintion

### Domain



The computational domain resembles the classic cfd benchmark with an added bar, with dimensions:

The box:  $L = 2.5$ ,  $H = 0.41$

The bar:  $l = 0.35$ ,  $h = 0.02$

The circle is positioned at  $(0.2, 0.2)$  making it 0.05 of center from bottom to top, this is done to induce oscillations to an otherwise laminar flow.

Boundary conditions:

The fluid velocity has a parabolic profile on the inlet that changes over time:

$$u(0, y) = 1.5u_0 \frac{y(H-y)}{(\frac{H}{2})^2}$$

$$u(0, y, t) = u(0, y) \frac{1 - \cos(\frac{\pi}{2}t)}{2} \text{ for } t < 2.0$$

$$u(0, y, t) = u(0, y) \text{ for } t \leq 2.0$$

We set no slip on the floor"and "ceilingso to speak.

On the fluid solid interface the boundary conditions are set to:

$$\sigma_f n_f = \sigma_s n_s \quad \text{on } \Gamma^0(\text{interface})$$

In our variational form we leave this out and so implying that they are equal.

### CSM test

Parameters

Tabell 1: My caption

Parameters	CSM1	CSM2	CSM3
$\rho_f [10^3 \frac{kg}{m^3}]$	1	1	1
$\nu_f [10^{-3} \frac{m^2}{s}]$	1	1	1
$u_0$	0	0	0
$\rho_s [10^3 \frac{kg}{m^3}]$	1	1	1
$\nu_s$	0.4	0.4	0.4
$\mu_s [10^6 \frac{m^2}{s}]$	0.5	2.0	0.5
$g$	2	2	2

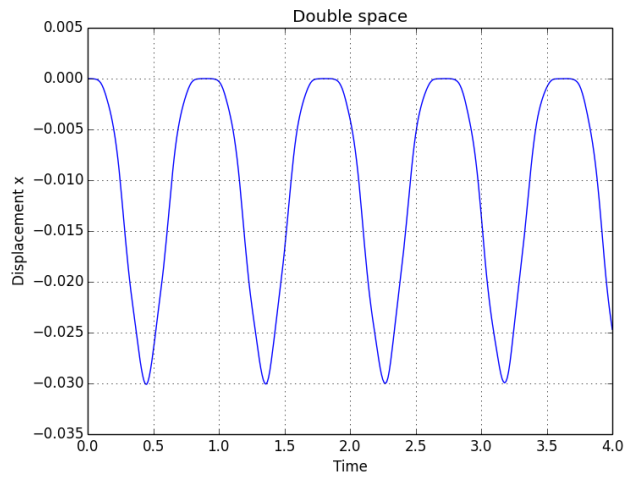


Figure 1: diff x with diffusion term

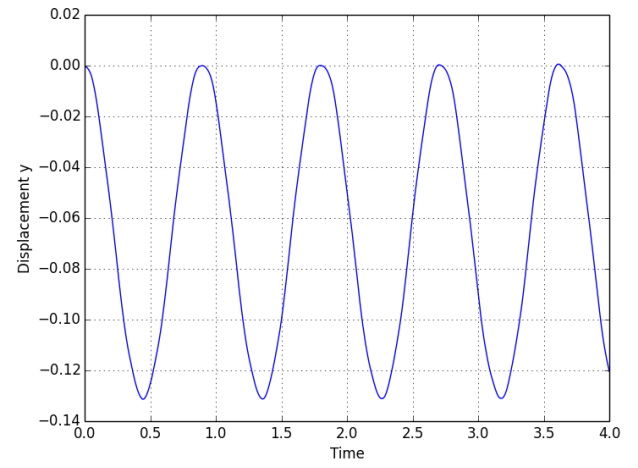


Figure 2: diff y with diffusion term

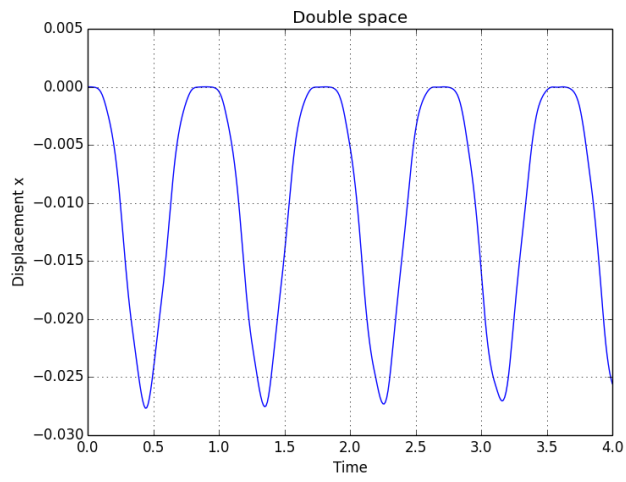


Figure 3: diff x without diffusion term

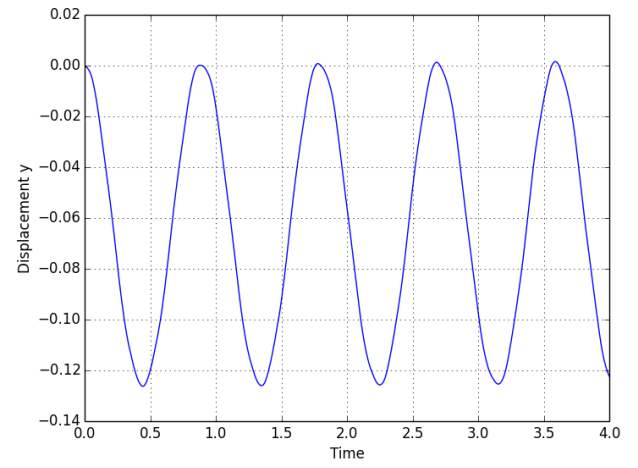


Figure 4: diff y without diffusion term

## FSI test

Results:

Tabell 2: Parameters

Parameters	FSI1	FSI2	FSI3
$\rho_f [10^3 \frac{kg}{m^3}]$	1	1	1
$\nu_f [10^{-3} \frac{m^2}{s}]$	1	1	1
$u_0$	0.2	1	2
$Re = \frac{Ud}{\nu_f}$	20	100	200
$\rho_s [10^3 \frac{kg}{m^3}]$	1	10	1
$\nu_s$	0.4	0.4	0.4
$\mu_s [10^6 \frac{m^2}{s}]$	0.5	0.5	2

Tabell 3: FSI 1

Cells	Dofs	ux of A $[0^{-3}]$	uy of A $[0^{-3}]$	Drag	Lift	Spaces
2698	7095	0.0234594	0.797218	14.4963	0.915801	P1-P1-P1 stab= 0.01
2698	23563	0.02271	0.80288	14.1736	0.787891	P2-P2-P1
10792	92992	0.0227341	0.808792	14.1855	0.801044	P2-P2-P1
43168	369448	0.227352	0.812595	14.227	0.797242	P2-P2-P1
<b>ref</b>	<b>ref</b>	<b>0.0227</b>	<b>0.8209</b>	<b>14.295</b>	<b>0.7638</b>	<b>ref</b>