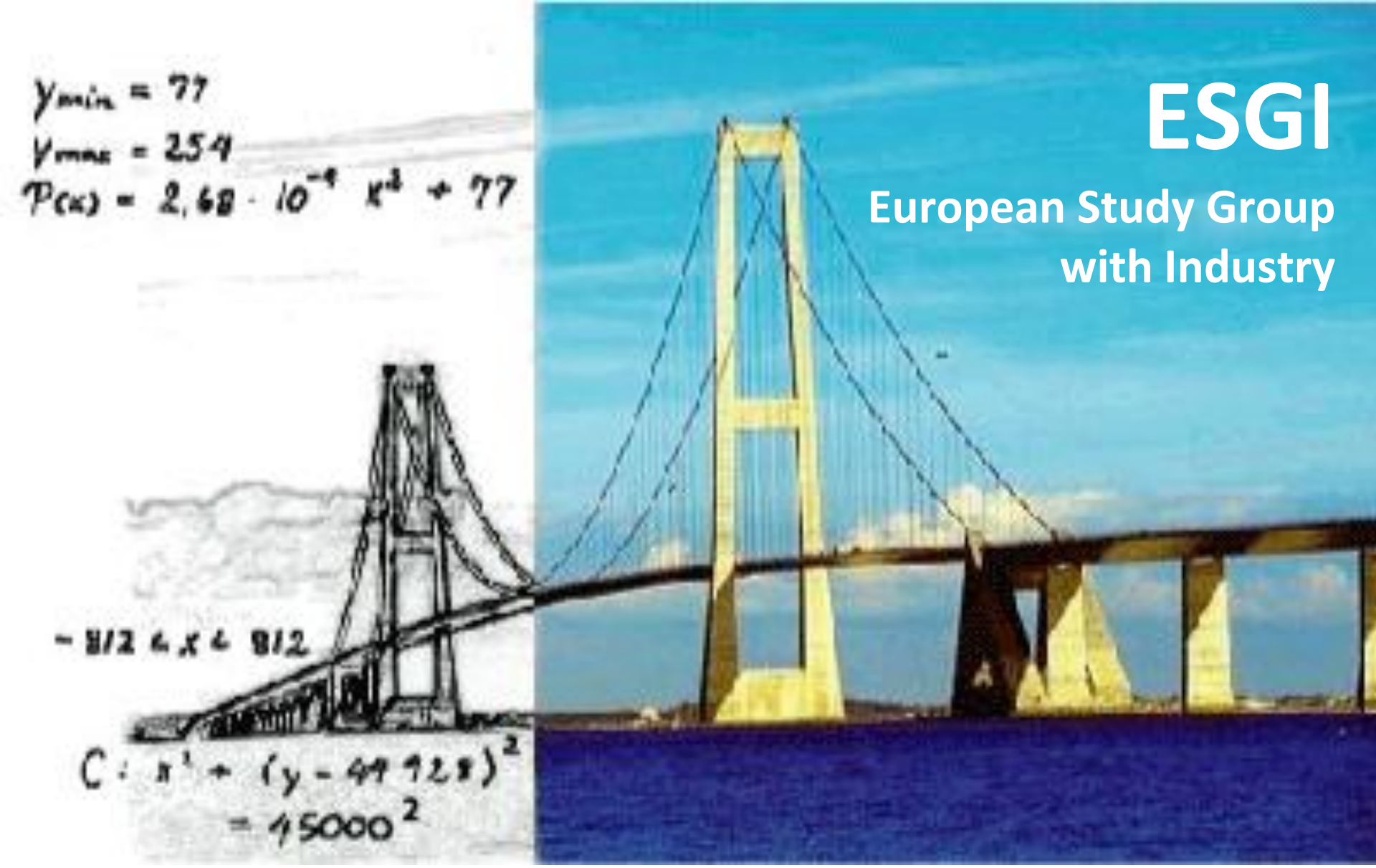

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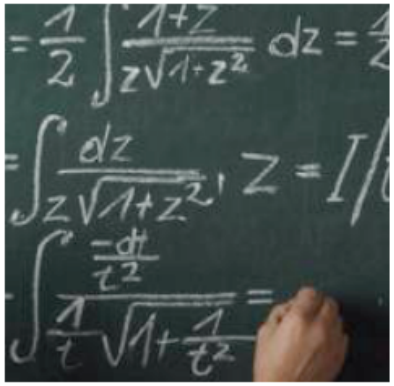
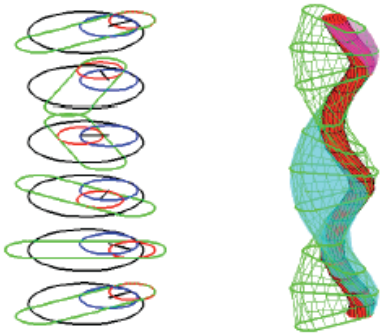
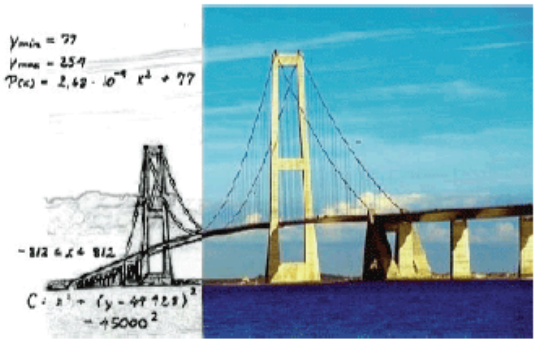






EUROPEAN STUDY GROUPS WITH INDUSTRY

1-uges Arbejdsmøde

European Study Groups with Industry, (ESGI) er et 1-uges arbejdsmøde hvor matematikere takler konkrete matemtiske problemstillinger fra virksomheder.

Hver virksomhed bringer en opgave til mødet.

Ved mødets begyndelse (mandag) præsenterer virksomhederne opgaverne.

Matematikerne arbejder herefter intensivt i grupper på at løse opgaverne.

Ved mødets slutning (fredag) præsenteres løsningerne for virksomhederne, og efterfølgende leveres en rapport til virksomheden.

I Danmark ligger mødet hvert år i august måned, enten på DTU (Kgs. Lyngby) eller på SDU (Odense/Sønderborg).

Pris

Hver deltagende virksomhed betaler **DKK 25.000** for deltagelse.

Virksomheden bedes derudover have en repræsentant til rådighed for arbejdsgruppen, så stor en del af ugen som muligt.

Arbejdsmødet giver

* input fra modelleringseksperter
* fokusering af problemstillinger
* brainstorm på løsningsmuligheder
* adgang til de nyeste teoretiske og beregningsmæssige teknikker

Erfaringer

ESGI arbejdsmøder har være afholdt i Danmark i over 10 år. Virksomheder som NOVO-Nordisk, Danfoss, Grundfos, Danisco, DSB, Danske Bank, DONG Energy, og mange mindre, også helt små, firmaer har deltaget.

Deltagende virksomheder har

* Fundet eksplicitte løsninger
* Fundet nye modeller af komplicerede problemstillinger
* Etableret kontakter til forskere
* Etableret kontakter med ph.d. studerende

UNIVERSITY OF SOUTHERN DENMARK.DK

ESGI…
European Study Group with Industry

ESGI: Få en gruppe af forskere til at arbejde for din virksomhed - ganske gratis

Som medlem af VE-Net har du nu mulighed for ganske gratis at få stillet et panel af ingeniører, fysikere og matematikere til rådighed for din virksomhed i en uge. Har din virksomhed en problemstilling af matematisk karakter, som I ikke selv vil kaste jer over – så er European Study Group with Industri (ESGI) måske noget for jer. Både små og store virksomheder er velkomne.

ESGI finder i år sted:

Mandag d. 15. - fredag d. 19. august 2010
på Syddansk Universitet i Sønderborg

FACULTY OF ENGINEERING
UNIVERSITY OF SOUTHERN DENMARK.DK

ESGI…
Problem example 1

Danfoss PolyPower

Peristaltic hydraulic pump based on DEAP materials

- 11 Researchers

  DTU, SDU (MMMI, MCI), Univ. of Southampton, Danfoss.

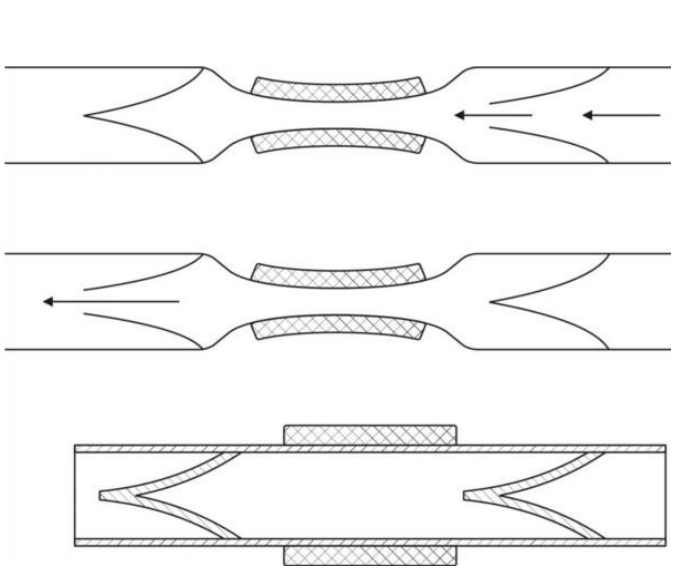
- Solution report (22 pages) with 3 different approaches and consideration of travelling waves and stacking of pumps

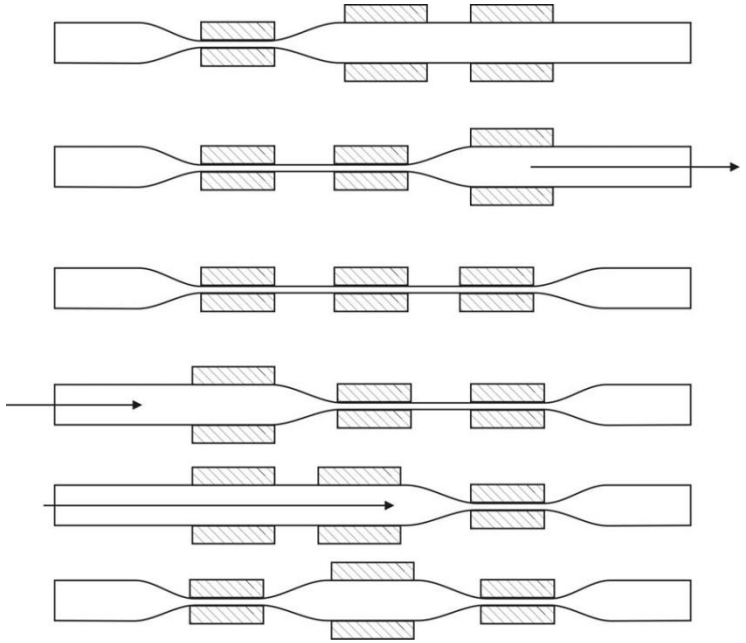
- Specific model build – Intensive work and sparring

ESGI...
Danfoss PolyPower

Background

The basic idea is to develop a peristaltic pump based on the Danfoss PolyPower Technology





ESGI…
Danfoss PolyPower

Problem statement

Please consider the problematic and propose a viable and efficient design based on optimal efficiency.

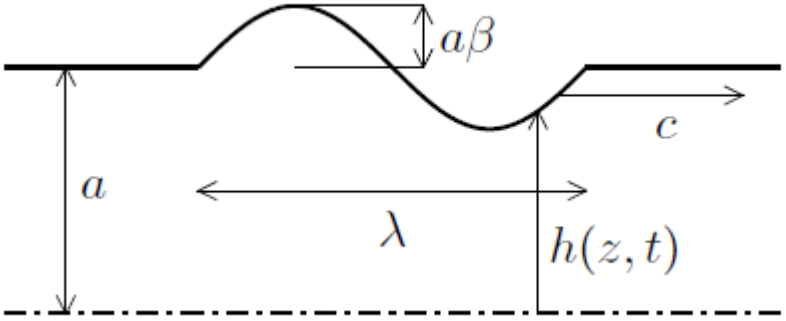
Pump specification:	Volume flow: 2.2 m3/h	Lift: 4 m water column (0.4 bar)
	System pressure: 10 bar	Max length of pump: 180 mm
	Pipe diameter: 1/2 inch	

How efficient a design I achievable? The system may be run at mechanical and electrical resonance.
A number of reasonable models describing the PolyPower actuator as a mass/spring/damper system exist.

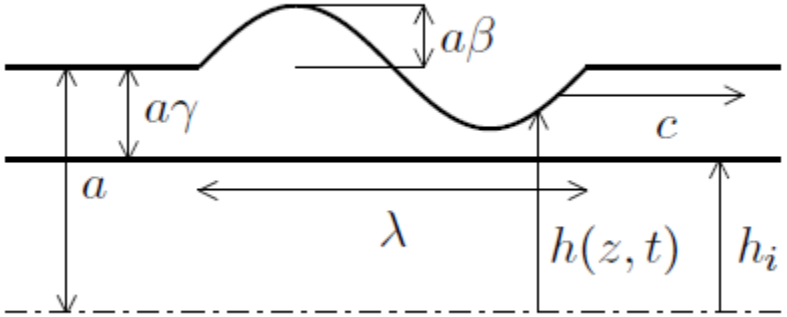
BR
Frands Voss
Danfoss Ventures A/S, 2010-08-12

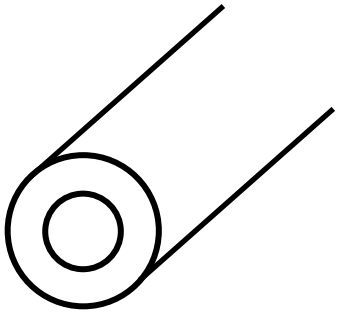
ESGI...
Danfoss PolyPower

Solution



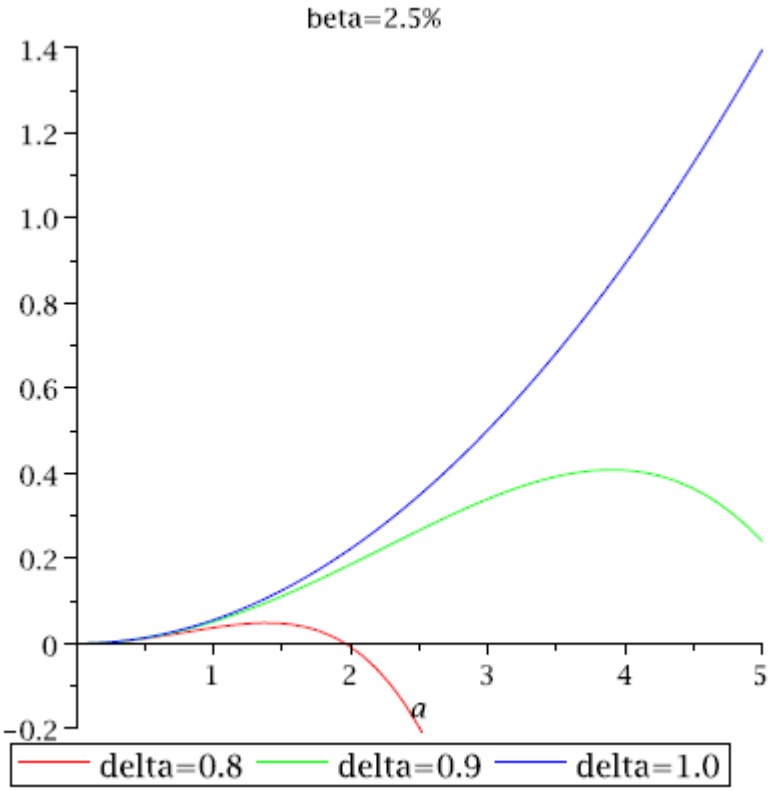
$$2\pi h\frac{\partial h}{\partial t}+\frac{\partial Q}{\partial z}=0,$$



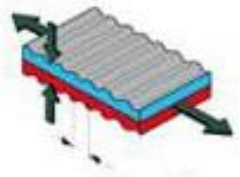


ESGI...
Danfoss PolyPower

Solution



ESGI...
Danfoss PolyPower



Danfoss Problem: Peristaltic Pumping Using Polymer Materials

Andreas Rune Fugl[1], Niels Fuglede[2], Jens Gravesen[2], Michael Pilegaard Hansen[2], Peter Røgen[2], Jens Starke[2], Mads Peter Sørensen[2], Colin Please[3], Frands Voss[4], Morten Willatzen[5]*, Lin Xiao[5]

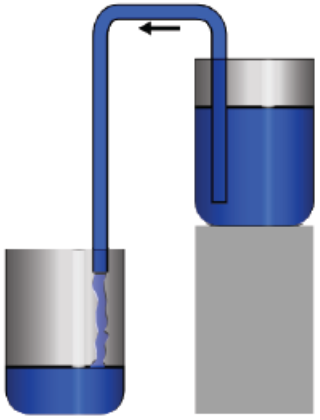
[1]Mads Clausen Institute and Maersk Institute, University of Southern Denmark
[2]Department of Mathematics, Technical University of Denmark
[3]Faculty of Mathematical Studies, University of Southampton
[4]Danfoss A/S
[5]Mads Clausen Institute, University of Southern Denmark

September 30, 2010

The Danfoss problem was split up in different subgroups where different subproblems were tackled. These include (a) a low Reynolds number one-dimensional analytical analysis for a cylindrical pipe and an annulus, (b) actuator stacking configurations, (c) a two-dimensional analysis of the low (or, actually zero) Reynolds number problem, (d) the high Reynolds number problem, and (e) a FEM analysis using the software COMSOL. The different treatments are described in the following.

ESGI…
Problem example 2

DHI Group



Design parameters for a siphon system

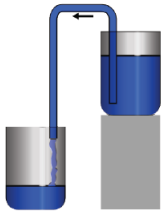
- 10 Researchers

  DTU, SDU, TU Eindhoven, Univ. of Southampton, Polish Acad. Sci. Warsaw, U. Oxford, DHIVand.

- Solution report (16 pages) with 5 different approaches, including electrical analogy and extension with groundwater effects

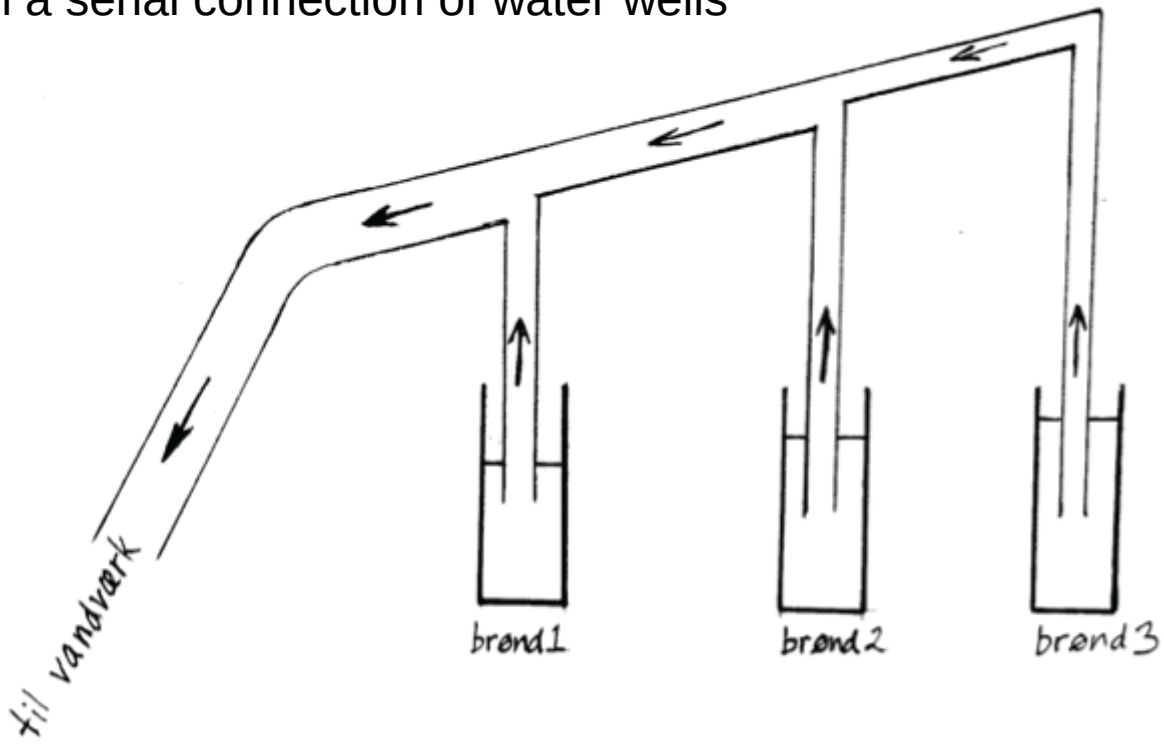
- Specific model build – Intensive work and sparring

ESGI…
DHI Problem

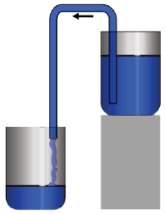


Background

The idea is to utilize the siphon principle in extraction of groundwater from a serial connection of water wells



ESGI…
DHI Problem



Problem statement

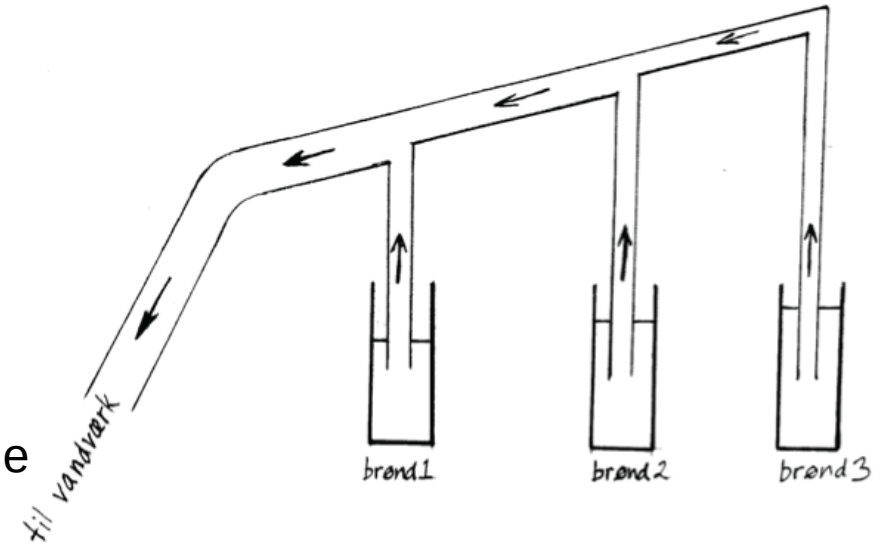
• What parameters in this system will determine the flow distribution from the wells?

• How will the water table in the wells influence the flow?

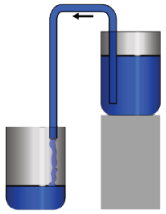
• How will pipe dimensions determine the flow?

• Can water go from one well to another?

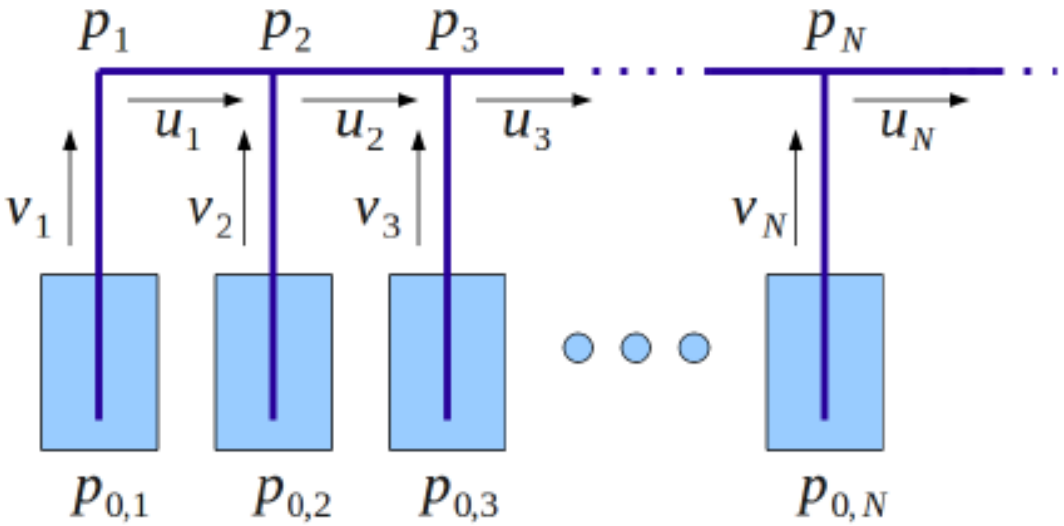
• Where in the system is the greatest risc of cavitation?



ESGI…
DHI Problem



Solution



$$v_j|v_j| = p_j - p_{0,j} \qquad u_j|u_j| = p_{j+1} - p_j \qquad u_{j+1} = u_j + v_j$$

$$\frac{d(A(x)u)}{dx} = B(x)v \qquad \text{for } 0 \le x \le L\,.$$

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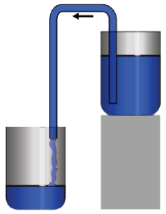
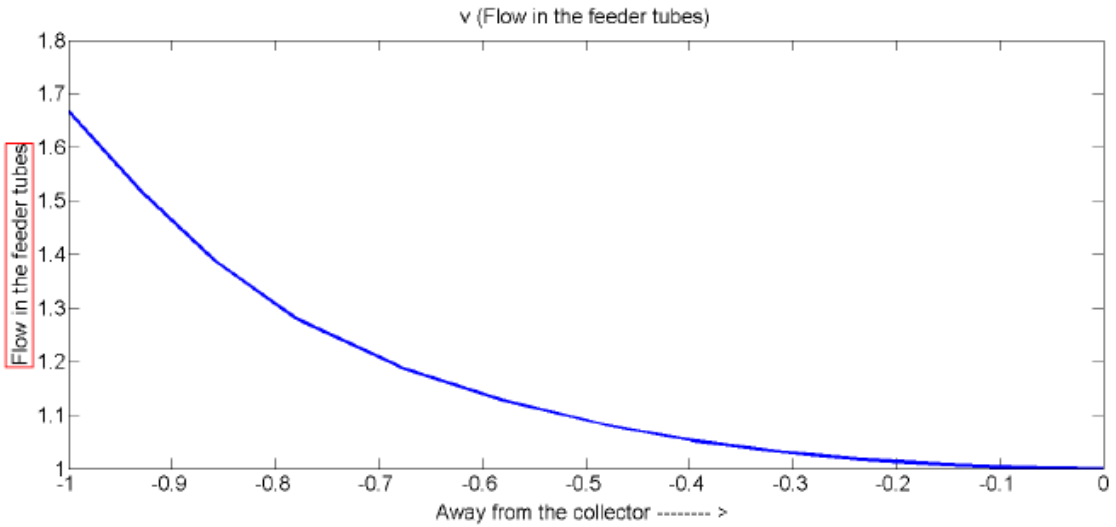
DHI Problem



Solution

$$A \propto (L - x)^{\frac{4}{5}}.$$

Samlerrør v. ens brøndbelastningn



Flow i samlerrør v. ens brønd-niveau

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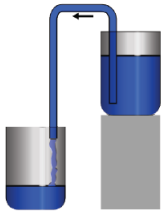
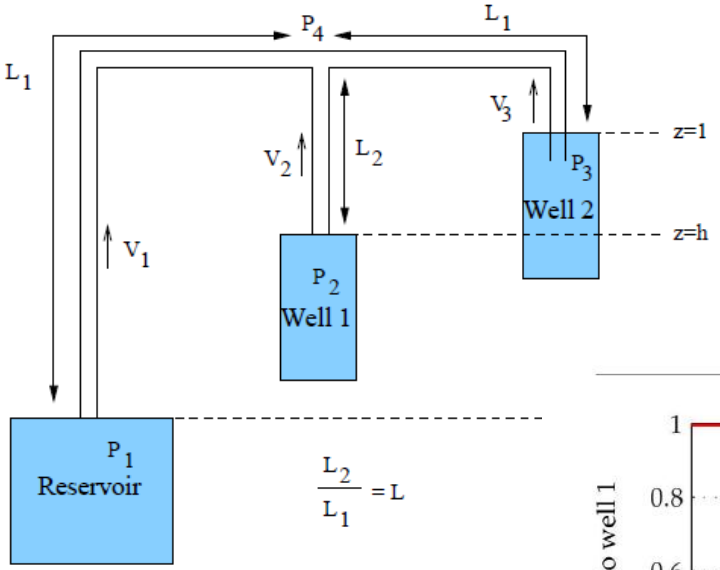
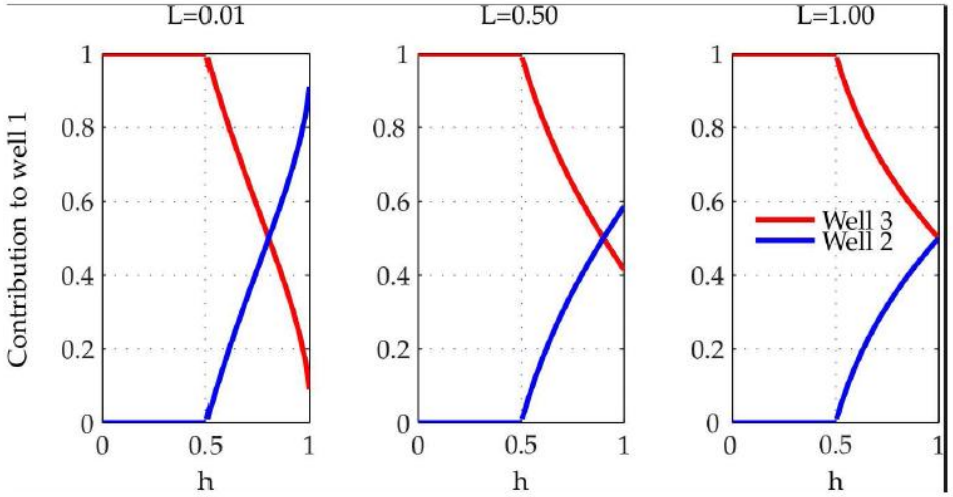
DHI Problem







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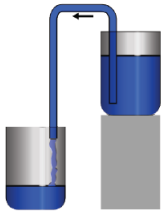
DHI Problem



Design Parameters for a Siphon System

Frank Schilder (DTU, Lyngby), Rune Christensen (DTU, Lyngby),
Jørgen Sylvest (USD, Odense), Kundan Kumar (TUE, Eindhoven),
Maria Rudnaya (TUE, Eindhoven), Valeriu Savcenco (TUE, Eindhoven),
Borys Sobiegraj (Polish Acad. Sci., Warsaw), Colin Please (U. Southampton),
Rob Style (U. Oxford)

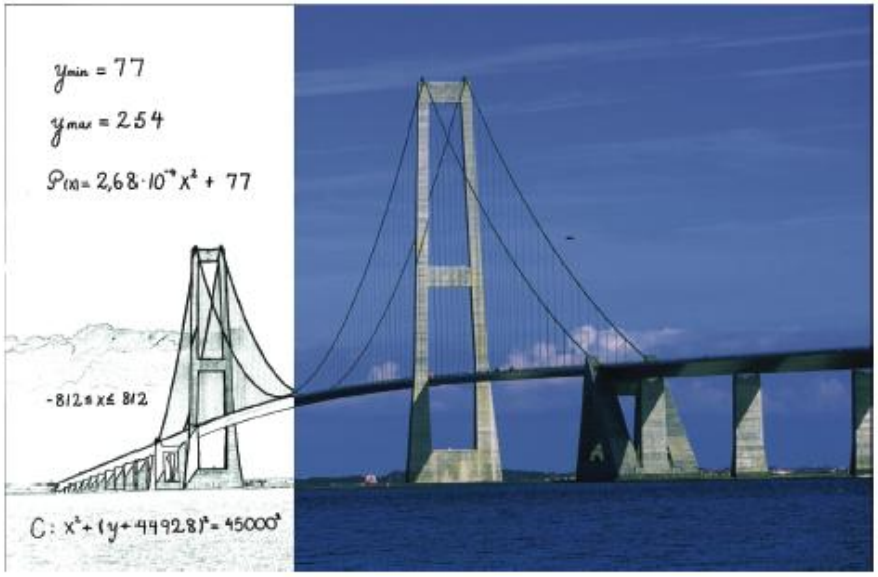
Problem Presenter: Anne Katrine Falk (DHIVand MiljøSundhed, Hørsholm)

76th EUROPEAN STUDY GROUP with INDUSTRY
Department of Mathematics
Technical University of Denmark
16 - 20 August 2010

1 Introduction

DHI are interested in understanding a rather unusual water extraction system that is operated by a water supply company. Typically when water is extracted from the ground a well is dug and a pump is installed in the well to push the water to the surface where it enters a distribution system of pipes. Such a system may consist of a dozen or so wells each

83. European Study Group with Industry



AUGUST 15-19, 2011
SØNDERBORG, DENMARK



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