Selected Slides from Presentation at Scandpower (Norway)

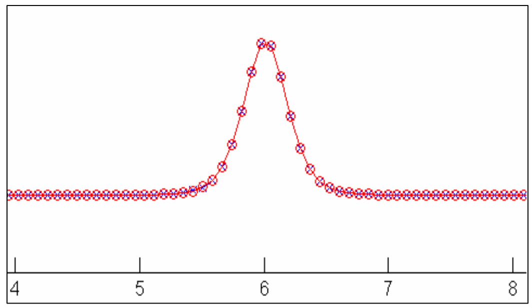
Title Slide

Pseudospectral Numerical Methods for Modelling of Waves in Pipe Flow

Håvard Holmås

Scandpower Petroleum Technology

September 27, 2006



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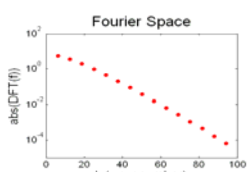
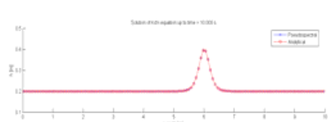
Mapping Slide

This presentation briefly explains pseudospectral methods and their advantages



Introduction to the Discrete Fourier Transform (DFT)

Main concepts of pseudo-spectral numerical methods



Numerical simulation of KdV equation

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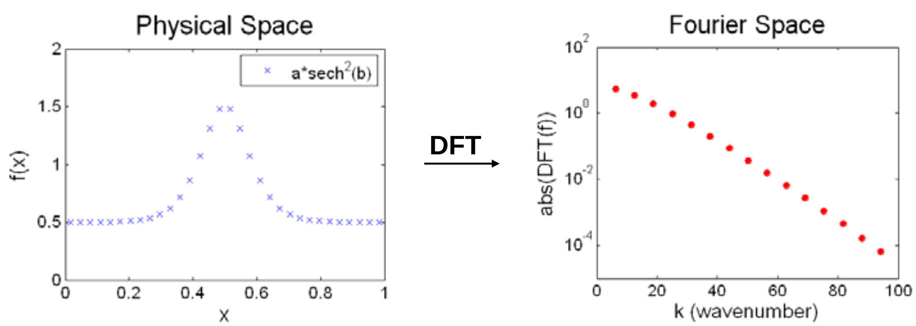
Slide from Section 1

The DFT represents a discrete function in terms of a series of sine and cosine elements



No information is lost in the Discrete Fourier Transformation

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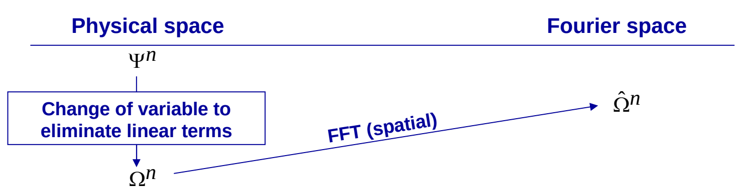
Slide from Section 2 (animation)

In pseudospectral methods some operations are carried out in Fourier space



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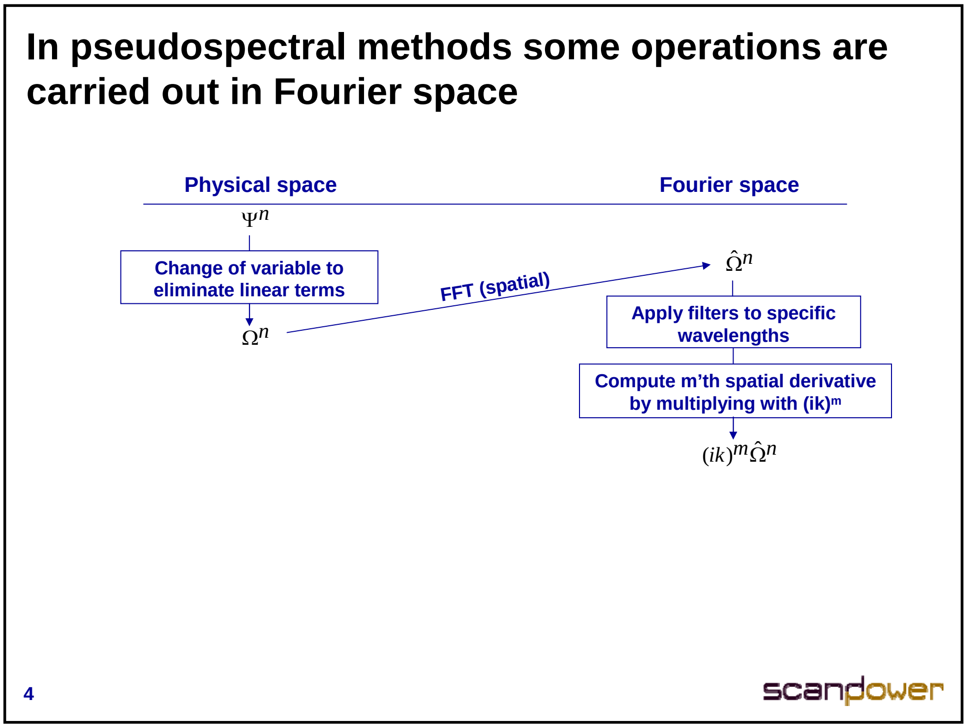
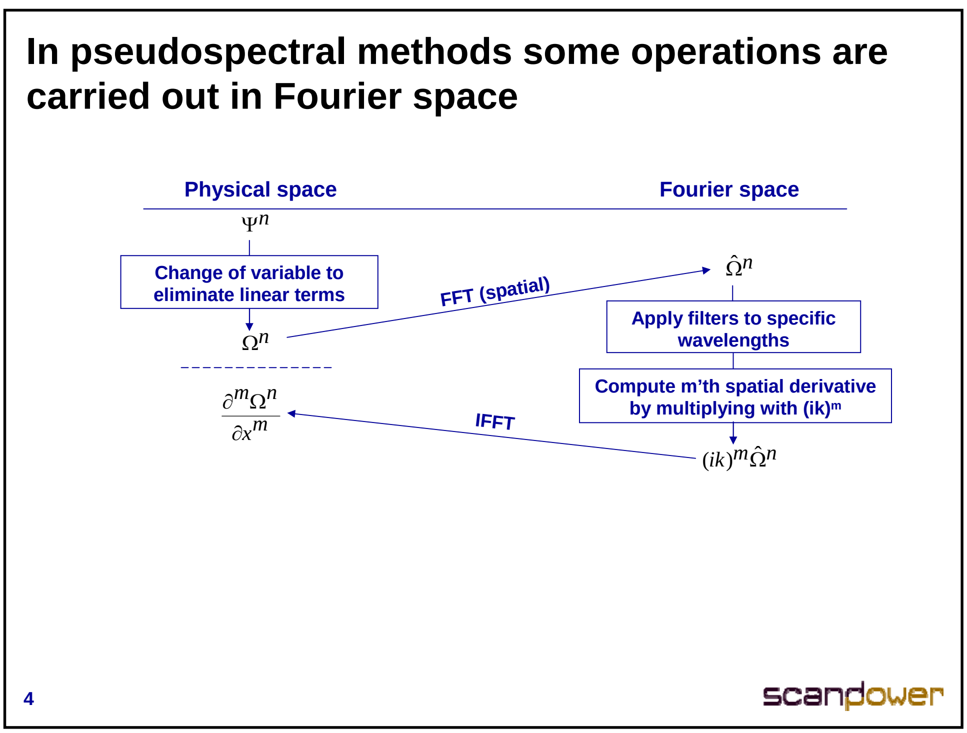
Slide from Section 2 (animation)



Slide from Section 2 (animation)



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Slide from Section 2 (animation)

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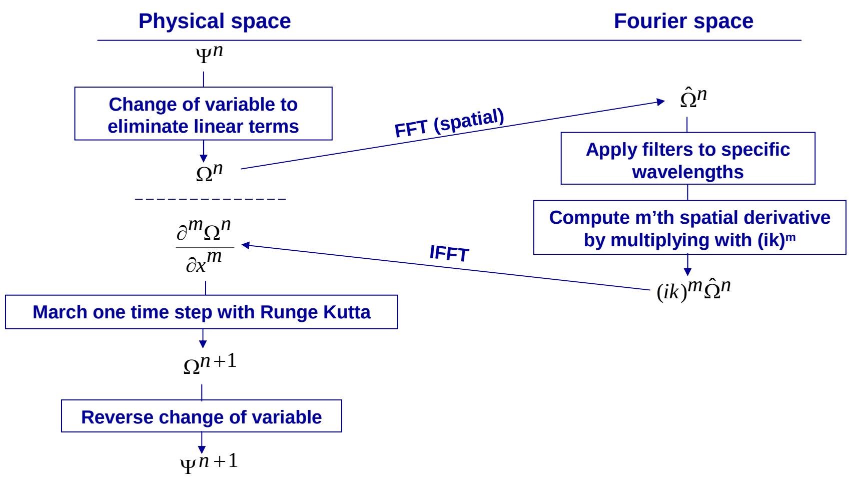

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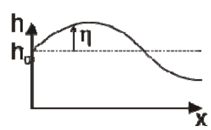
Slide from Section 3 (animation)

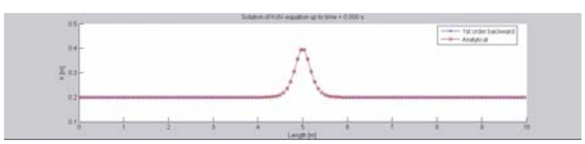
The numerical diffusion is significantly reduced compared to common Finite Volume Methods (FVM)

Numerical simulation of KdV equation

$$\eta_t + c_0\eta_x + \frac{3\,c_0}{4\,h_0}\left(\eta^2\right)_x + \frac{c_0 h_0^2}{6}\eta_{xxx} = 0$$



1. **1st order backward discretization**



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Selected Slides from Presentation at Scandpower (Norway)

Slide from Section 3 (animation)

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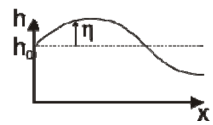

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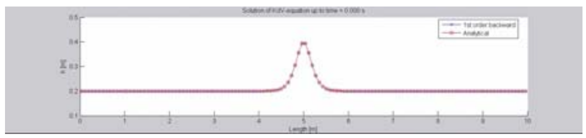
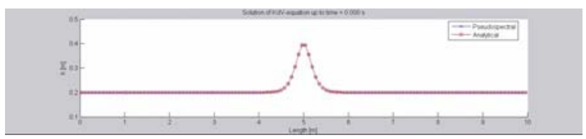


2. **Pseudospectral discretization**



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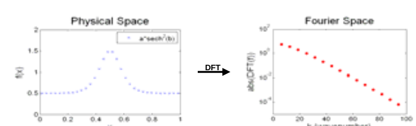
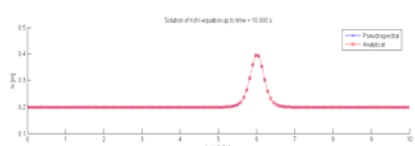
Conclusion Slide

In summary, pseudospectral methods appear very promising as a tool for simulation of waves

Build on the Discrete Fourier Transformation



Reduce numerical diffusion compared to FVMs



Questions?

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