



PROGRAMME  
DE RECHERCHE  
NUMÉRIQUE  
POUR L'EXASCALE

# Building physics-based multilevel surrogate models from neural networks.

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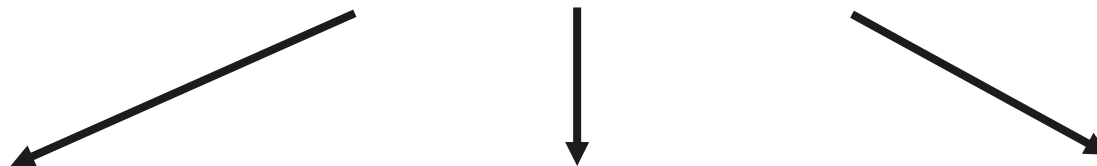
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# Applications in wave propagation



**Acoustics**

**Electromagnetism**

**Seismology**

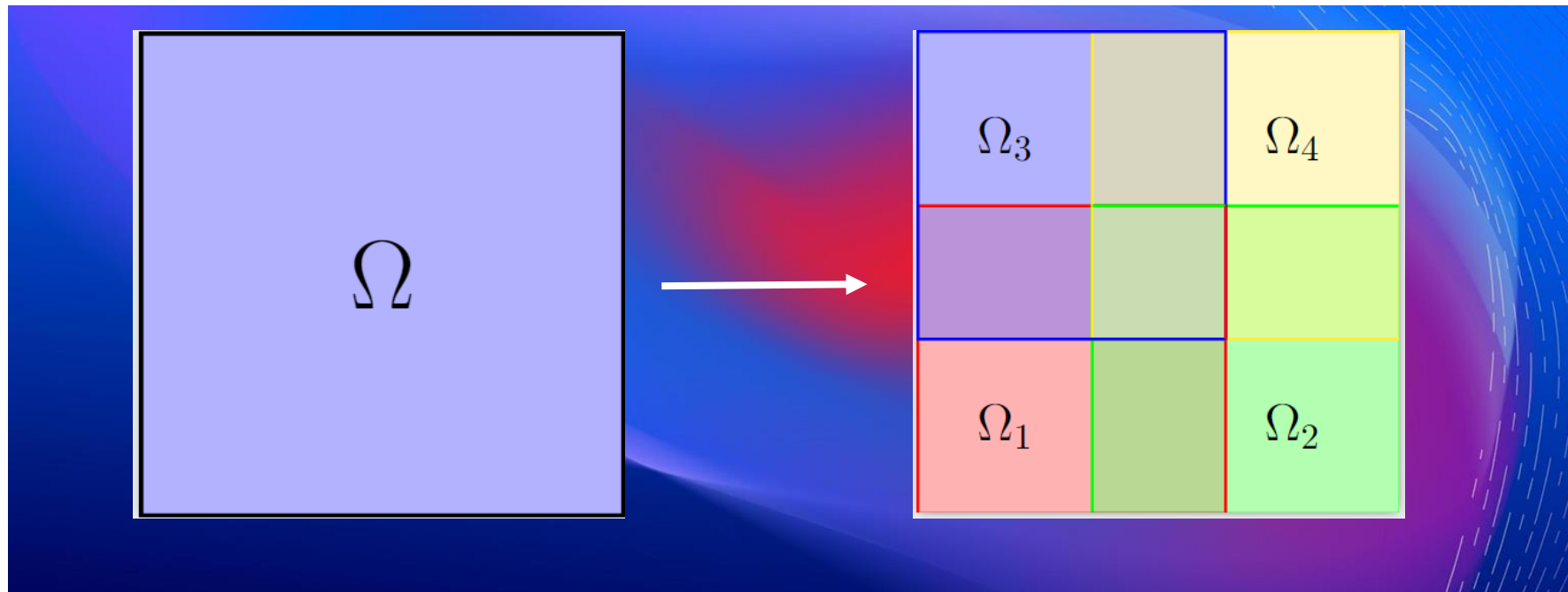
*Helmholtz equation*

$$-\Delta u(x) - k^2 u(x) = f(x)$$

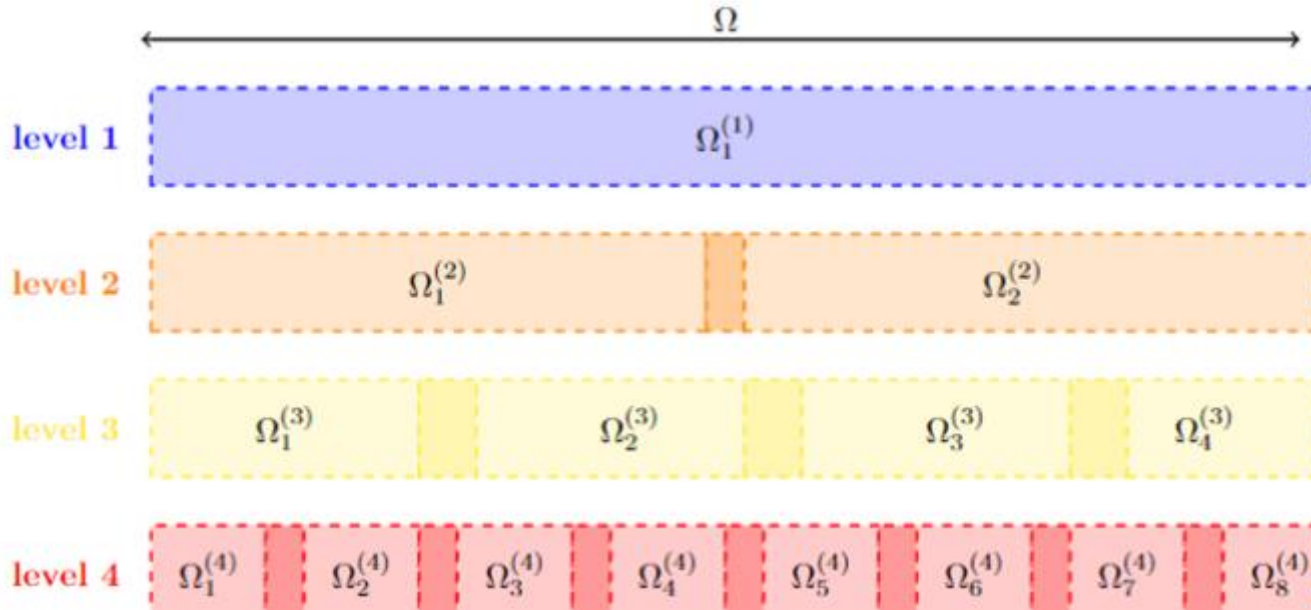
# PINNs



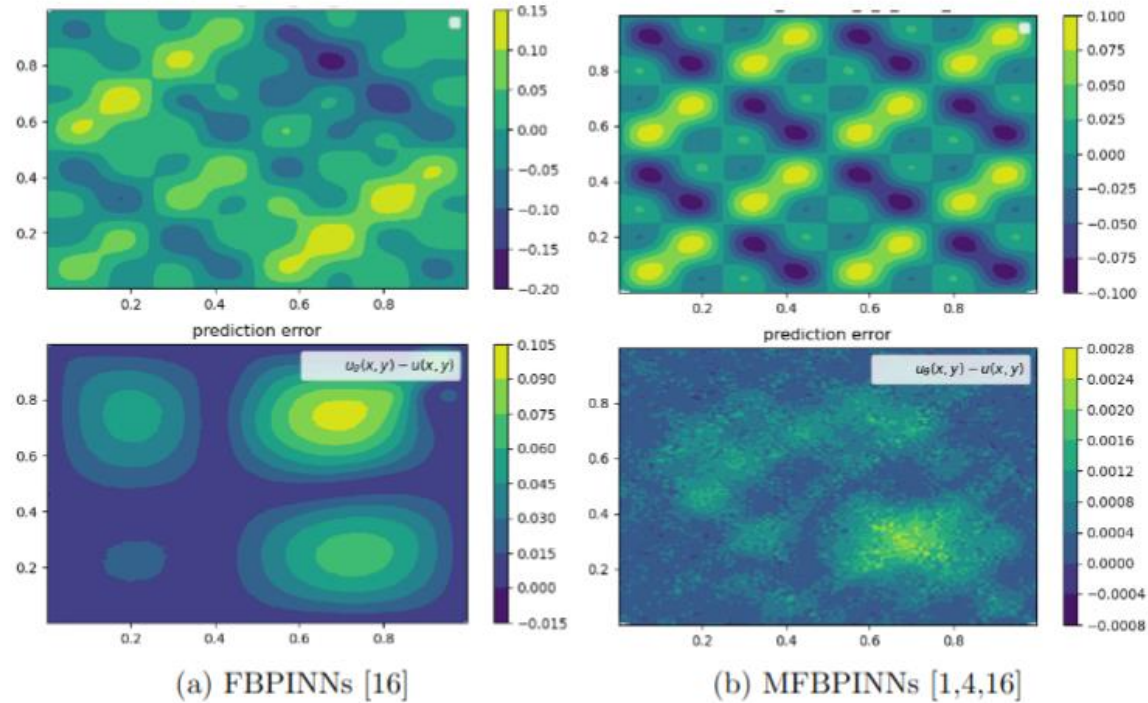
# FBPINNs



# Multilevel FBPINNs



# Results



# Main goals

## *Increasing Problem Complexity*

- Higher frequencies
- 3D wave propagation problems
- Non-homogeneous domain

## *Improving the efficiency and scalability*

- Optimizing training speed and adapting algorithms to leverage parallelism
- Sampled or randomised networks



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