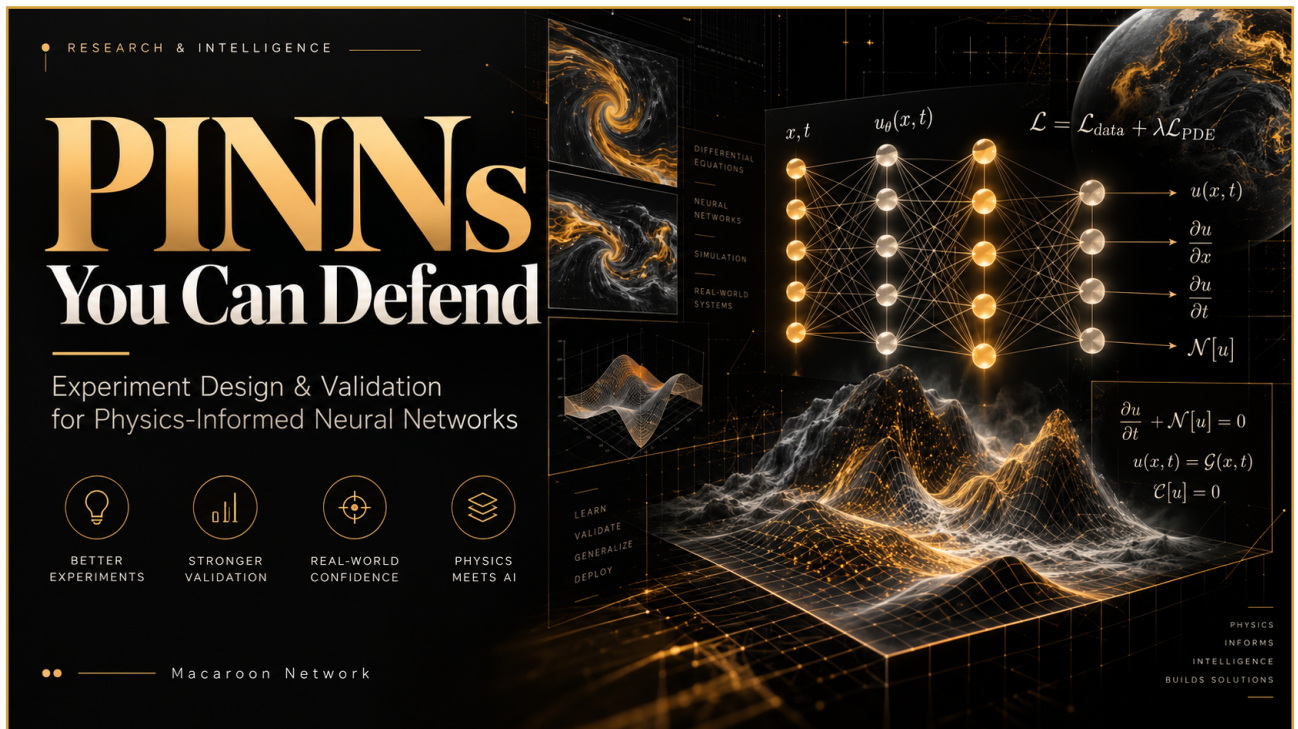




OFFICIAL SAMPLE PREVIEW

32 pages in the full edition - this preview intentionally contains only a small sample.

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- Use provenance, controlled experiments and failure diagnosis to qualify a PINN.

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- ☐ Continuity, momentum and energy equations for the heated-channel case
- ☐ Real VortX request/response structure
- ☐ PhysicsNeMo training controls
- ☐ Independent finite-difference validation
- ☐ Real 1,000-epoch benchmark metrics
- ☐ 10-experiment improvement matrix and 15-minute audit method

The complete edition is 32 pages. This sample does not include the complete exercises, chapter teaching, templates, worked material or final reference sections.

Sample: a falling loss curve is not a physics result

A PINN is trained to minimize an objective that represents pieces of the governing physics. That is valuable, but it does not remove the need for validation. The optimizer can satisfy the weighted training objective while a field remains inaccurate in a region that was poorly sampled or weakly constrained.

In the POLYMATHICA/VortX heated-channel workflow, the model returns u , v , p and T fields together with residual loss, validation metrics and provenance. The important design choice is that the candidate PINN is compared against an independent finite-difference reference rather than being allowed to validate itself.

The validated default uses a bounded `heated_channel_2d` request with 1,000 epochs, a 0.001 learning rate, 512 collocation points, 128 boundary points and seed 551. The reference run showed much lower relative error in velocity than temperature, which immediately tells you where further experiments should focus.

The full POLYMATHICA Edition explores that workflow in detail, including failure modes, controlled hyperparameter studies, provenance, asynchronous GPU execution and a practical PINN review method.

Preview boundary: this excerpt is intentionally short. The full ebook develops the subject through complete chapters, examples, exercises and reference material.

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