Deep Reinforcement Learning for Radiative Heat Transfer Optimization Problems

E. Ortiz-Mansilla[1,2], J. J. García-Esteban[1,2], J. Bravo-Abad[1,2] and J. C. Cuevas[1,2]
[1]Departamento de Física Teórica de la Materia Condensada, Universidad Autónoma de Madrid, 28049, Madrid, Spain
[2]Condensed Matter Physics Center (IFIMAC), Universidad Autónoma de Madrid, 28049, Madrid, Spain

eva.ortizm@estudiante.uam.es

Reinforcement learning is a subfield of machine learning that is having a huge impact in the different conventional disciplines, including physical sciences. Here, we show how reinforcement learning methods can be applied to solve optimization problems in the context of radiative heat transfer. We illustrate their use with the optimization of the near-field radiative heat transfer between multilayer hyperbolic metamaterials. Specifically, we show how this problem can be formulated in the language of reinforcement learning and tackled with a variety of algorithms. We show that these algorithms allow us to find solutions that outperform those obtained using physical intuition. Overall, our work shows the power and potential of reinforcement learning methods for the investigation of a wide variety of problems in the context of radiative heat transfer and related topics.

References

[1] E. Ortiz-Mansilla, J. J. García-Esteban, J. Bravo-Abad, J. C. Cuevas, Phys. Rev. Appl., 22 (2024) 054071.

Figures

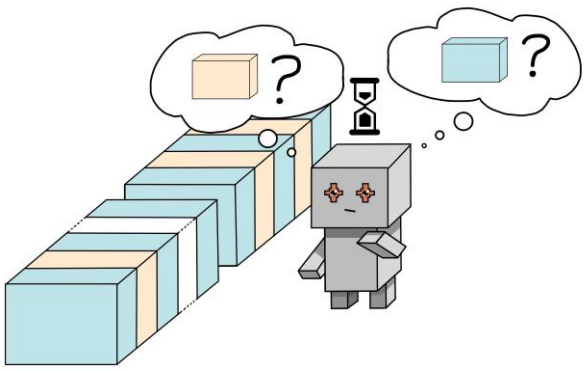

Figure 1. Reinforcement Learning schema for the enhancement of near-field radiative heat transfer through the design of a multilayer system.