IOCPh 2025 Conference

The 1st International Online Conference of the Journal Philosophies



10-14 June 2025 | Online

The dialectical philosophy of intelligent models and mathematical physics simulations in wave motion research

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INTRODUCTION & AIM

INTRODUCTION

With the development of natural philosophy, the issue of wave motion has gradually attracted attention. There are numerous wave motion problems in the science and engineering fields, such as in earthquake engineering, marine engineering and acoustic vibration research.



RESULTS & DISCUSSION

The use of intelligent models to solve wave motion problems has gradually become a mainstream and hot topic; however, the natural philosophical value of intelligent models and mathematical physics simulations in solving wave motion problems should be regarded dialectically.

For instance, deep learning models with large number of parameters, often with more than a billion or even tens of billions or trillions of parameters, can handle complex wave motion problems.

The Golden Gate Bridge

The London Eye

AIM

The purpose of wave motion research includes exploring the basic principles of wave propagation and solving practical problems in science and engineering. The dialectical philosophy in it will be studied.

METHOD

Deductive Reasoning & Historical Criticism & Dialectical Reasoning

Its research paradigms include a data-driven paradigm and a principle-driven paradigm. Wave motion problems are usually expressed using differential equations or variational principles. For a long time in the past, differential equations or variational equations of wave motion problems had been solved through mathematical physics simulations. Mathematical physics simulations include numerical simulation and analytical methods.



The Responses at Different Ranges

The Simulation Model in Wave Motion

Therefore, intelligent models can provide more accurate target identification, more efficient solutions and faster prediction. Compared to mathematical physics simulations, however, they lack natural philosophical interpretability, physical consistency and basic mathematical principles.

CONCLUSION

In conclusion, intelligent models and mathematical physics simulations have independent and high philosophical values in wave motion research, and they should be given equal attention.

FUTURE WORK / REFERENCES

FUTURE WORK

In future, hope to talk about and review more dialectical philosophy of intelligent models and mathematical physics simulations in wave motion research.

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With the development of computers, intelligent models have gradually been applied to solve scientific and engineering problems requiring a large amount of computation and data, including wave motion. There are data-driven intelligent models, physics-informed intelligent models and coupled data-driven and physicsdriven intelligent models. Data-driven intelligent models require a theory and knowledge of artificial intelligence and data analysis, including machine learning, image processing and signal processing. Physics-driven intelligent models require a theory and knowledge of artificial intelligence and numerical analysis, including network structures, network geometries and residual penalties.



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