Configured Structures and Their Representation

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Abstract

The authors herein present their thoughts on an intersection between architecture and information theory.

In this note, the authors look at free-body diagrams [1] of configured mechanical structures. They propose that the physical forces and their mutual geometry are the critical aspects which allow reproduction of a configuration. Further, two configurations with the same free-body diagram can be considered equivalent. In this light, we have equivalence classes being represented. Thus the number of possibilities when reconstructing is increased.

If the free-body diagram is thought of as an information source, entire 3D StudioMax architectural designs can be thought of as realizations of a free-body diagram "process." However, due to the equivalence class structure, multiscale signal representations might be relevant (see the dyadic tree in Figure 1 of [2]). In this context, one can ask: what is the fundamental number of bits needed to represent a mechanical structure?

Next, one considers time-varying forces and structures with dynamics. One can raise the same question but now the answer will be in terms of the entropy rate of the corresponding free-body diagram stochastic process [3]. We can also look at forces and their back action in the quantum setting [4] and extend the formalism thus far developed above to this setting. Finally, in geometrodynamics [5], forces are absent and the curvature of spacetime "tells" matter how to move and so it would be a non-trivial extension to incorporate such non-traditional settings into the formalism. With this incorporation, the "carriage" of curvature in gravitational waves can be looked at in a new information theoretic light, with concomitant consequences for the analysis of the detection of these waves [6].

These considerations have obvious implications wherever mechanical structures are represented and used. In future work, this can be extended to electrical structures with charge and current flows replacing free body diagrams. This setting will have its own particular details that will lead to efficient representations. Noise in the mechanical and electrical representations can then also be considered as either a deleterious process or a process generating novel structures and representations.

References

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