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Validating quantum systems in the presence of errors

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Experimental groups around the world are developing complex quantum systems for quantum simulation and eventually computation. These systems will hopefully soon exceed our ability to classically simulate or reasonably understand their dynamics. I will discuss efforts to develop testing tools for such systems to confirm various aspects of their performance in the presence of errors, disorder, and noise. The overall formalism focuses on using quantum communication concepts to validate performance, and I will show how it can extend to a variety of quantum systems.