A Swinging Atwood's Machine that Hiccups

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A swinging Atwood’s machine (SAM) is consisted of a pendulum, a counterweight, and a massless string connecting the two. The pendulum is allowed to swing around the horizontal bar holding the system while the counterweight falls down. The counterweight might get hitched to the bar as the string winding around the bar tightens up and causes a large enough friction. What is interesting is that we discovered that the swinging Atwood’s machine might even “hiccup” and show stick-and-slip motion several times if the system parameters are suitably chosen. Having experimentally investigated this phenomenon and constructed a phase diagram showing the various regimes exhibited by the system, we supplemented it with numerical simulations and proposed a theoretical explanation for what had been observed.

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