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Self-Excited Stick–Slip Oscillations of Drag Bits

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This note studies the self-excited stick-slip oscillations of a rotary drilling system with a drag bit, using a discrete model which takes into consideration the axial and torsional vibration modes of the bit. Coupling between these two vibration modes takes place through a bit-rock interaction law which accounts for both frictional contact and cutting processes at the bit-rock interface. The cutting process introduces a delay in the equations of motion which is ultimately responsible for the existence of self-excited vibrations, exhibiting stick-slip oscillations under certain conditions.

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