Tableau 7

Is the outcome of a coin toss *really* random?

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The toss of a coin

Air resistance

Gravitational force

Angular velocity

Initial velocity

Mass density

Floor elasticity

Air resistance

Gravitational force

Angular velocity

Initial velocity

Mass density

Floor elasticity

A coin toss as a deterministic physical system

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Gravitational force

Angular velocity

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A coin toss as a deterministic physical system

A sanitised model of a coin toss

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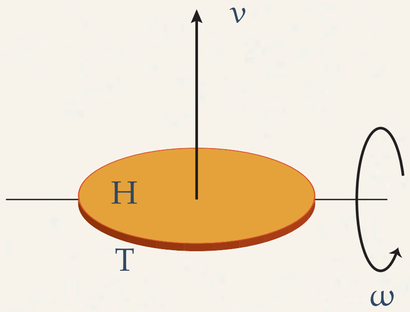
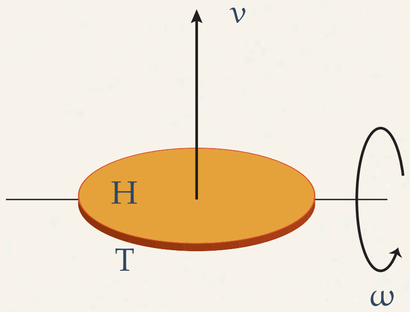


- Coin: thin uniform disk, one side marked “Head”, the other “Tail”.
- Initial conditions (time $t = 0$): Head facing upwards; the coin is tossed straight up with initial velocity v and angular velocity ω about the horizontal axis. Measure coin height vertically from centre of mass at rest, coin rotation with respect to horizontal axis. Initial height $y(0) = 0$; initial angular orientation $\theta(0) = 0$.
- At time t: Coin height $y(t)$, angle with horizontal $\theta(t)$.
- Termination time $t = \tau$: Catch the coin at its initial height when its centre of mass returns to its initial position. Final height $y(\tau) = 0$; final angular orientation $\theta(\tau)$.

A sanitised model of a coin toss

$y(0) = 0, \quad \theta(0) = 0$



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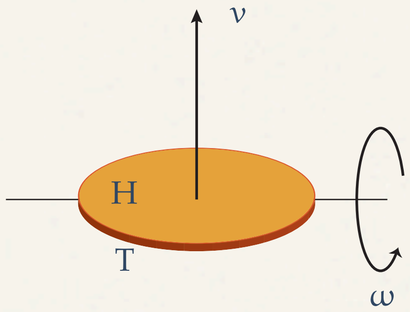

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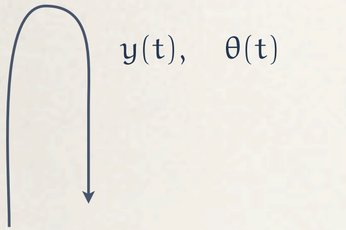

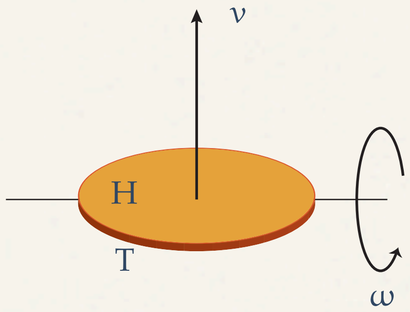

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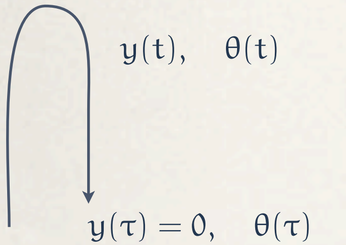

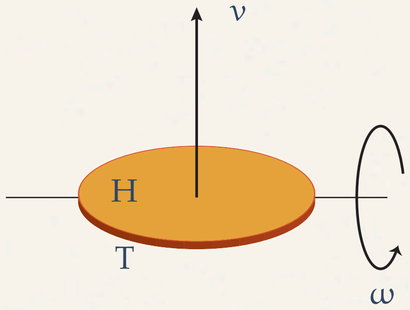

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