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Dynamical states in the sensorimotor loop of a rolling robot BULCSÚ SÁNDOR, TIM JAHN, LAURA MARTIN, RODRIGO ECHEVESTE, CLAUDIUS GROS, Institute for Theoretical Physics, Goethe University Frankfurt — We investigate the closed sensorimotor loop of a simple rolling robot as a dynamical system. Using the LpzRobots simulation package [1], we construct robots with cylindrical body, controlled by a single proprioceptual neuron with a time dependent threshold. Despite its simplicity, we obtain a rich set of rolling modes, as a result of the self-organizing processes arising through the feedback within the sensorimotor loop. These rolling modes are robust against environmental noise, since they correspond to stable limit cycle attractors. However, for certain parameters they also allow for explorative behavior via internal noise induced switching. Furthermore, we also find a region of parameters in which the motion is fully embodied, where, in engineering terms, the engine powering the motion of the robot is turned on dynamically through the feedback of its very motion [2].

[1]R. Der & G. Martius, **The Playful Machine: Theoretical Foundation and Practical Realization of Self-Organizing Robots**, Springer Science & Business Media, Vol. 15, 2012
[2]B. Sándor, T. Jahn, L. Martin & C. Gros, **The sensorimotor loop as a dynamical system: How regular motion primitives may emerge from self-organized limit cycles**, to be published, 2015

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