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The on-off ground asymmetry during running on sand

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1. Introduction

During running, the mechanical energy of the centre of mass of the body (COM) fluctuates throughout the step like a spring-mass system bouncing vertically on the ground. This system oscillates around an equilibrium point at which the vertical acceleration of the COM (a_v) is nil (Cavagna, 2009). The step period can be divided into two parts (Figure 1): the first part (t_{ce}) during which $a_v > 0$ (lower part of the oscillation), and the second part (t_{ae}) during which $a_v \leq 0$ (upper part of the oscillation). At all speeds, t_{ce} corresponds to one-half period of the oscillation of the bouncing system, whereas t_{ae} corresponds to the second half only if the aerial phase is nil. Indeed, if the body leaves the ground, the elastic model is not anymore valid since $a_v = -1\ g$.