**Supplementary Section:**

The parameters of the one-legged handspringing model simulated in this work are shown inTable 1.

**Table 1. Parameters of the simulated model**

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| Nondimensional Parameters of Simulated Model | | | | | |
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In order to find the different limit cycles, trial and error is used to determine the appropriate initial condition and the controllers’ parameters.

In Table 2, each section illustrates different parameters of each limit cycle obtained by trial and error. These parameters are comprised of:

* PD controllers’ coefficients and desired values
* Fixed point
* Maximum Jacobian matrix's eigenvalues (for stability analysis of each limit cycle)
* for each cycle (which determines the considerable subset of the cycle’s region of attraction)
* Period of each limit cycle
* Step length in each cycle
* Slip length in landing
* Slip length in takeoff

**Table 2. Parameters of limit cycle**

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