Summary of replies to the editor and reviewer comments

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RC: *Reviewer Comment*,   **AR:** *Author Response*

We would like to thank the editor and reviewers for their thorough review and comments, as well as for their substantial praise of the work. We provide our replies to editor's and all reviewers' comments. The editor's and reviewers' comments are shown in blue. Our answers are shown in black. The modified and added content in the revised manuscript is shown in red.

1. Reviewer #3

RC: I have read the manuscript. Authors have revised the manuscript as per suggestion. So, this manuscript is suitable for publication in this journal.

AR: We greatly appreciate your careful review and your agreement to the publication of this manuscript.

2. Reviewer #4

RC: The revised version gives much information on developing the control system of the robot. However, information about how to modify, or not to modify, the initial values of the controller parameters during the training or testing process is not given. That is, how to initialize all the values of the network parameters every time before starting to run the robot?

AR: We have now summarized all the control parameters of the controller as shown in the following table (Table S.2). The parameters belong to the four basic modules (the CPGs, MNs, DFFB, and DIL) of the controller. Their initial values and short descriptions are listed in the table. Most of these parameters are constant and remain unchanged after initialization. They are initialized every time before starting to run the robot. Only three parameters (e.g., $\beta(n)$, $w_1(n)$, and $w_2(n)$) are changed overtime. They are adapted based on the DFFB and DIL modules when the controller is running.

To make it easy to understand these parameters, we have now added the table in the supplementary material and mentioned this in line 336 in the revised manuscript as:

"The control parameters of the adaptive quadruped motor controller are listed in Table S.2 of the Supplementary material."

Table S.2. Parameters of the adaptive quadruped motor controller. All these parameters are empirically set.

Modules	Symbols	Initial values	Description	Adaptive /constant
CPGs	$\mathbf{w}$	$\begin{pmatrix} 1.4 & 2.6 \\ -2.6 & 1.4 \end{pmatrix}$	Synaptic weights of the SO(2) CPG neurons	Constant
	$\mathbf{b}$	$\begin{pmatrix} 0.01 & 0.01 & 0.01 & 0.01 \\ 0.01 & 0.01 & 0.01 & 0.01 \end{pmatrix}$	Biases of the SO(2) CPG neurons	Constant
	$\boldsymbol{\Phi}$	$\begin{pmatrix} 0.0 & -\pi & -\pi & 0.0 \\ \pi & 0.0 & 0.0 & \pi \\ \pi & 0.0 & 0.0 & \pi \\ 0.0 & -\pi & -\pi & 0.0 \end{pmatrix}$	Desired relative phases among the four CPGs	Constant
	ϵ	0.01	CPG communication gain	Constant
MNs	α	0.16 for Lilibot and 0.12 for Laikago	Synaptic weight projection from the CPGs to MNs	Constant
	$\beta(n)$	0	Online-modulated by the DFFB	**Adaptive**
DFRL	$w_1(n)$	0.003	Online-modulated by the DIL	**Adaptive**
	$w_2(n)$	0.0032	Online-modulated by the DIL	**Adaptive**
	w_3	2	DFFB output gain of the knee joint	Constant
	w_4	1	DFFB output gain of the hip joint	Constant
DIL	A_f	0.01	Retention rate of the fast learner	Constant
	B_f	0.05	Learning rate of the fast learner	Constant
	C_f	0.001	Integral learning rate of the fast learner	Constant
	A_s	0.1	Retention rate of the slow learner	Constant
	B_s	0.01	Learning rate of the slow learner	Constant
	C_s	0.0001	Integral learning rate of the slow learner	Constant