**Supplementary Material**

**Exemplary stabilization diagrams in ERA conducted for muscle vibration signals**

The Fig. S1 presents stabilization diagram in the ERA procedure applied to signals measured for Subject 1 in third time point for both legs and rectus femoris in two considered states.

It depicts a relatively wide vibrations spectrum, represented here by power spectral density function (PSD) and several frequencies identified by the ERA technique as natural frequencies of a system. They are marked by black crosses, denoting MAC and damping criteria satisfaction. The marks occur several times for each natural frequency, as several orders of eigenvalue problem are considered.



Fig. S1. Stabilization diagram in the ERA procedure applied to signals measured for Subject 1 in the third time point in: (a) ACL leg, RF relaxed; (b) ACL leg, RF tight; (c) reference leg, RF relaxed; (d) reference leg, RF tight

**The oscillations frequencies identified in RF muscles in both legs, across all time points and peak torque values for subsequent subjects**

For ACL subjects  ,  ;

For reference subjects , .

Table 1. Natural frequencies of rectus femoris in ACL (*fa*) and reference legs (*fr*) and peak torque measured for reference (*Tr*) and ACL (*Ta*) legs in subsequent time points. Subject 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Time point | Muscular state | *fr* ± *dfr* [Hz] | *fa* ± *dfa* [Hz] | *Df* | *Tr* [Nm] | *Ta* [Nm] | *DT* |
| VIII.2022 | relaxed | 11.92±1.34 | 8.37±0.47 | 0.297 | - | - | - |
| IX.2022 | 7.74±0.29 | 7.06±0.09 | 0.088 | 102 | 72 | 0.293 |
| IX.2023 | 8.75±0.74 | 8.22±0.26 | 0.053 | 97 | 105 | -0.082 |
| IX.2024 | 8.66±1.96 | 8.67±1.70 | -0.002 | 108 | 97 | 0.099 |
| VIII.2022 | tense | 13.69±3.83 | 10.85±3.00 | 0.207 |  |  |  |
| IX.2022 | 14.54±0.64 | 13.06±0.43 | 0.102 |  |  |  |
| IX.2023 | 11.37±1.62 | 12.08±1.39 | -0.062 |  |  |  |
| IX.2024 | 9.03±2.04 | 9.44±2.13 | -0.046 |  |  |  |

Table 2. Natural frequencies of rectus femoris in ACL (*fa*) and reference legs (*fr*) and peak torque measured for reference (*Tr*) and ACL (*Ta*) legs in subsequent time points. Subject 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Time point | Muscular state | *fr* ± *dfr* [Hz] | *fa* ± *dfa* [Hz] | *Df* | *Tr* [Nm] | *Ta* [Nm] | *DT* |
| 17.I.2024 | relaxed | 7.53±1.05 | 6.69±0.44 | 0.111 | - | - | - |
| 28.II.2024 | 7.82±1.40 | 8.42±1.34 | -0.076 | 198 | 103 | 0.480 |
| 10.IV.2024 | 8.12±1.24 | 7.35±0.71 | 0.095 | 213 | 179 | 0.160 |
| 22.V.2024 | 8.60±1.24 | 8.27±1.38 | 0.038 | 202 | 168 | 0.168 |
| 17.I.2024 | tense | 10.48±2.81 | 10.24±2.58 | 0.022 |  |  |  |
| 28.II.2024 | 9.78±2.84 | 7.61±2.13 | 0.222 |  |  |  |
| 10.IV.2024 | 8.92±2.51 | 9.27±2.96 | -0.039 |  |  |  |
| 22.V.2024 | 8.61±2.62 | 8.31±2.47 | 0.035 |  |  |  |

Table 3. Natural frequencies of rectus femoris in ACL (*fa*) and reference legs (*fr*) and peak torque measured for reference (*Tr*) and ACL (*Ta*) legs in subsequent time points. Subject 3

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Time point | Muscular state | *fr* ± *dfr* [Hz] | *fa* ± *dfa* [Hz] | *Df* | *Tr* [Nm] | *Ta* [Nm] | *DT* |
| 10.VII.2024 | relaxed | 8.24±1.94 | 7.83±0.75 | 0.050 | - | - | - |
| 30.VIII.2024 | 8.57±1.03 | 8.29±1.33 | 0.033 | 259 | 127 | 0.51 |
| 19.XI.2024 | 7.44±1.05 | 7.24±1.11 | 0.026 | 300 | 215 | 0.28 |
| 10.VII.2024 | tense | 9.18±2.54 | 8.42±0.49 | 0.083 |  |  |  |
| 30.VIII.2024 | 8.15±1.77 | 9.08±1.99 | -0.114 |  |  |  |
| 19.XI.2024 | 9.96±2.42 | 10.50±2.97 | -0.054 |  |  |  |

Table 4. Natural frequencies of rectus femoris in both legs: right (*fr*) and left (*fl*) and peak torque measured for right (*Tr*) and left (*Tl*) legs in reference subjects.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Subject | Muscular state | *fr* ± *dfr* [Hz] | *fl* ± *dfl* [Hz] | *Df* | *Tr* [Nm] | *Tl* [Nm] | *DT* |
| 4 | relaxed | 7.50±1.30 | 7.51±1.79 | 0.0013 | 249 | 197 | 0.209 |
| 5 | 9.04±1.31 | 9.42±1.10 | 0.041 | 148 | 116 | 0.216 |
| 6 | 9.18±1.72 | 9.82±1.72 | 0.065 | 193 | 204 | 0.054 |
| 7 | 8.16±2.26 | 8.55±1.92 | 0.046 | 197 | 195 | 0.010 |
| 4 | tense | 7.36±1.37 | 6.90±0.83 | 0.064 |  |  |  |
| 5 | 9.66±2.49 | 9.20±3.72 | 0.047 |  |  |  |
| 6 | 10.88±4.24 | 10.57±2.68 | 0.028 |  |  |  |
| 7 | 9.60±2.80 | 10.85±3.32 | 0.12 |  |  |  |