7. Supplementary Material

7.1. Harbour seal (Phoca vitulina), animal 2, whisker 1
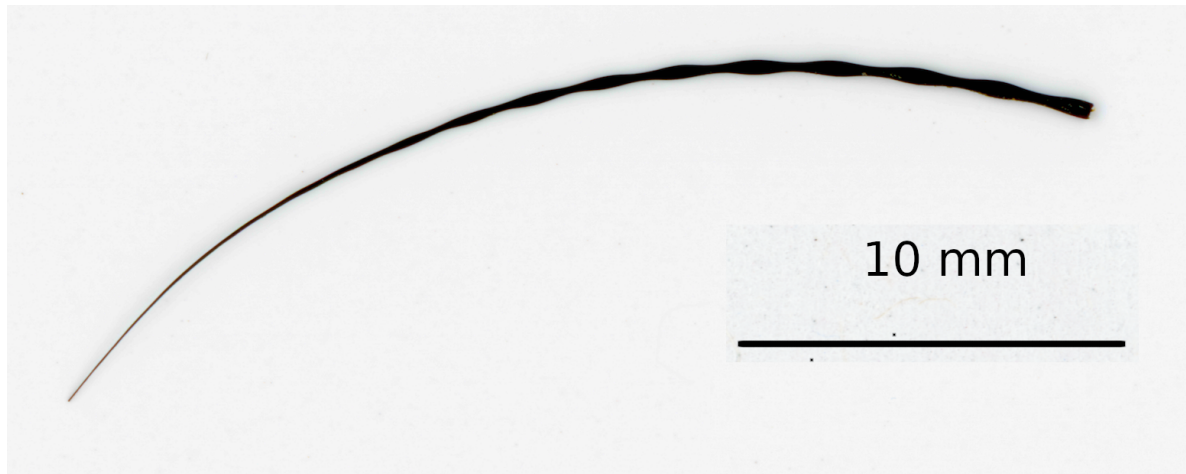

Figure 10. A scan of a harbour seal whisker. The whisker was scanned at a resolution of 1.985 microns per pixel.
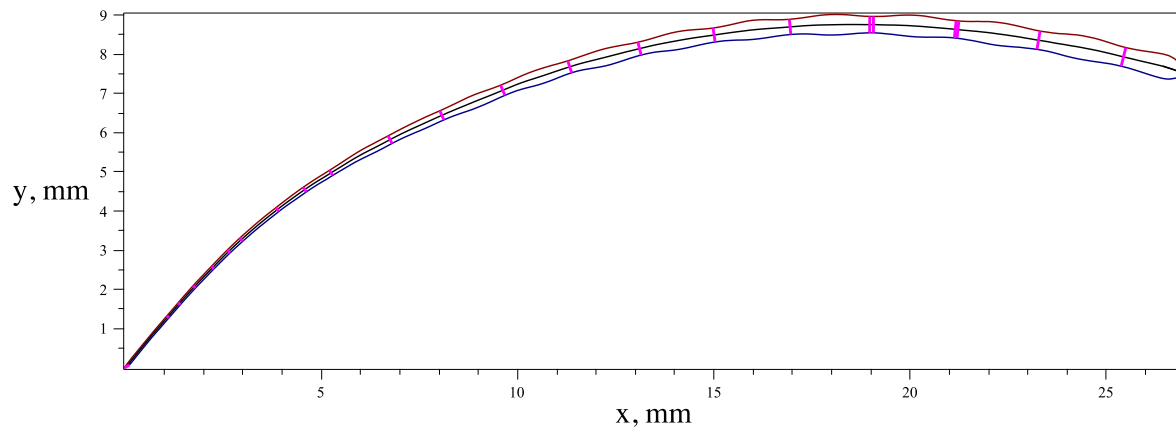

Figure 11. Normal centreline (black) for a harbour seal whisker. Minimal chords are shown violet.
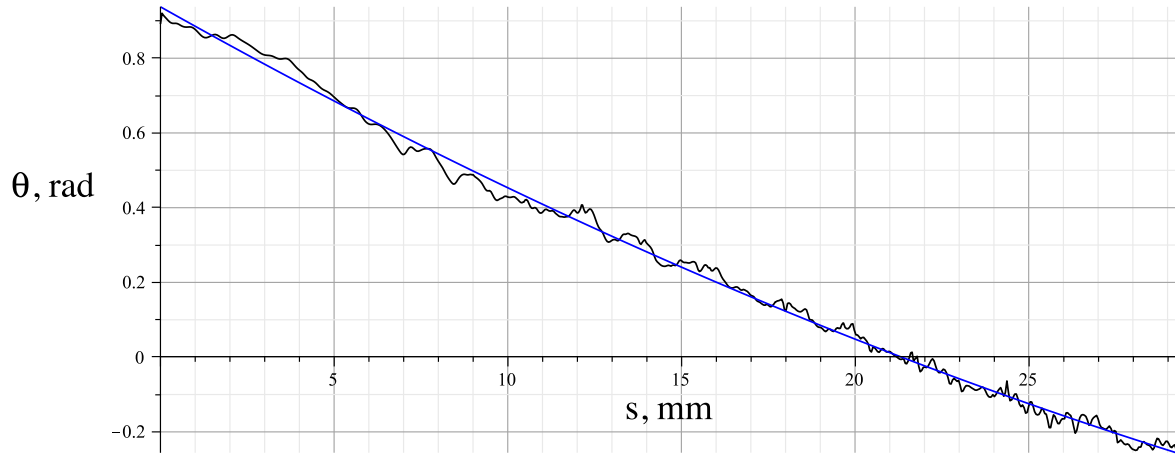
Figure 12. The tangential angle θ for the normal centreline as a function of the arclength s for a harbour seal whisker. The second-order polynomial linear fit $\bar{\theta}(s) = 0.938 - 0.524 \cdot 10^{-1}s + 0.396 \cdot 10^{-3}s^2$ is shown in blue ($R^2 = 0.996$).
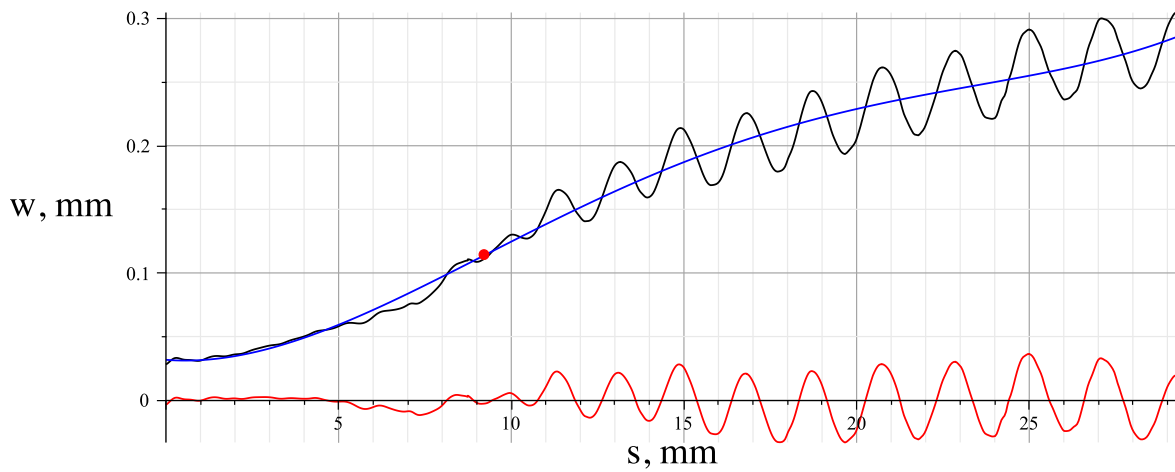

Figure 13. Half-width w as a function of the normal centreline length s for a harbour seal whisker (black). The fourth-order polynomial linear fit $\bar{w}(s) = 0.317 \cdot 10^{-1} - 0.214 \cdot 10^{-2}s + 0.199 \cdot 10^{-3}s^2 - 0.100 \cdot 10^{-3}s^3 + 1.528 \cdot 10^{-4}s^4$ is shown in blue ($R^2 = 0.961$). The red dot marks the inflection of the polynomial function at the arclength $s^\star = 9.23$ mm about one third (0.32) of the full length. The red curve shows the oscillation amplitude of the half–width (the difference between the black and blue curves $\Delta w(s) = w(s) - \bar{w}(s)$).
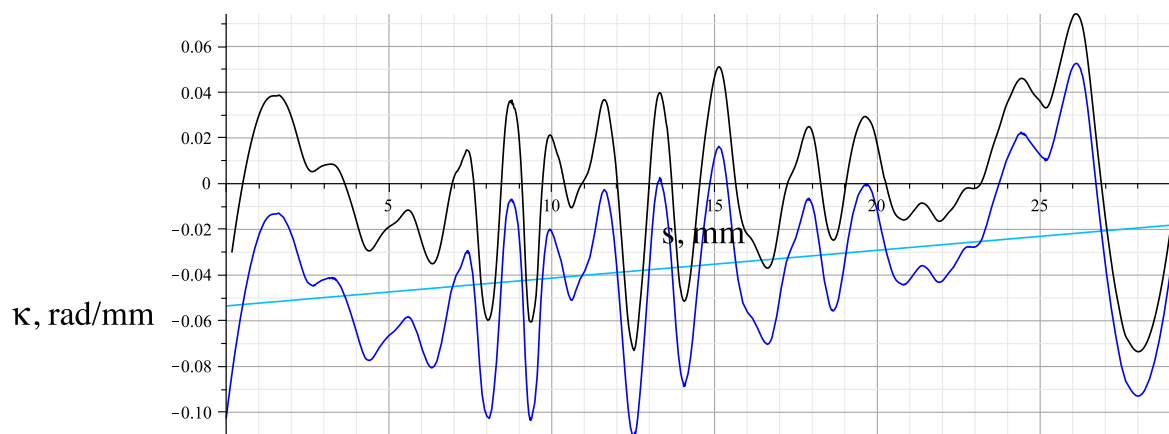
Figure 14. The smoothed curvature $\kappa(s)$ (blue) of the normal centreline, the first-order polynomial linear fit $\bar{\kappa}(s) = -0.535 \cdot 10^{-1} + 0.122 \cdot 10^{-2}s$ (light blue) and the difference $\Delta\kappa = \kappa(s) - \bar{\kappa}(s)$ (black).
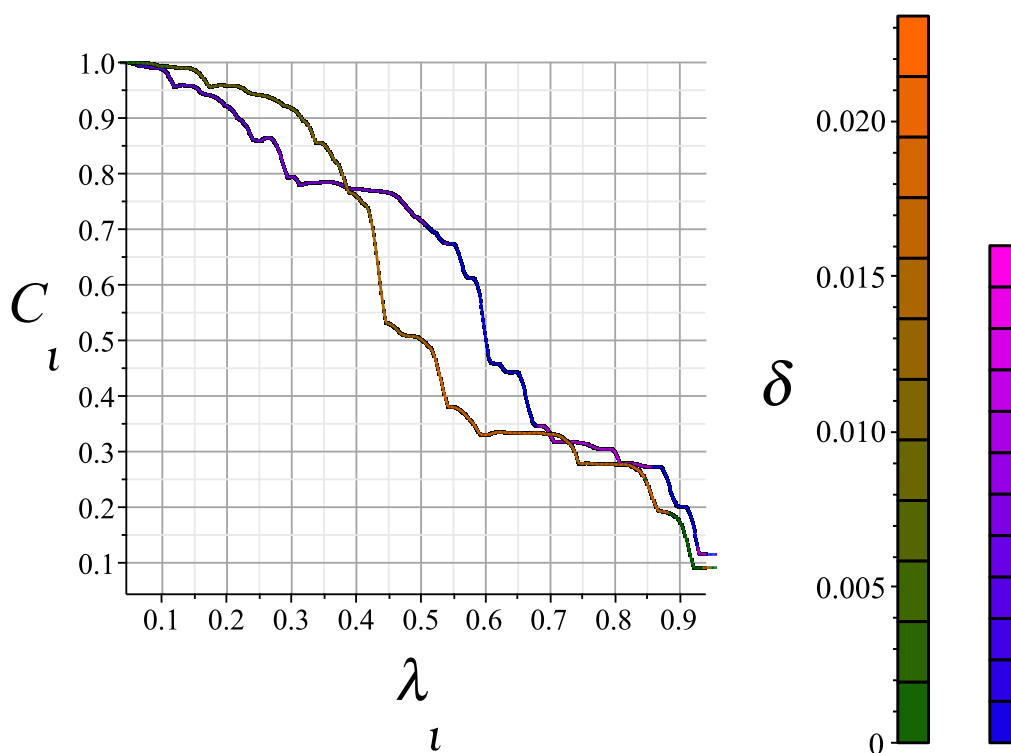

Figure 15. Width-curvature correlation coefficients $C_\iota(\ell)$ as functions of the fraction λ_ι of the correlation maximising whisker length interval to the full length ($\lambda_1 := \ell/L$ for $\iota = 1$, blue-magenta) and to the oscillation interval ($\lambda_2 := \ell/(L - s^\star)$ for $\iota = 2$, green-orange). The colour encodes the relative shift $-\delta$ along the arclength that corresponds to $C_\iota(\ell)$.
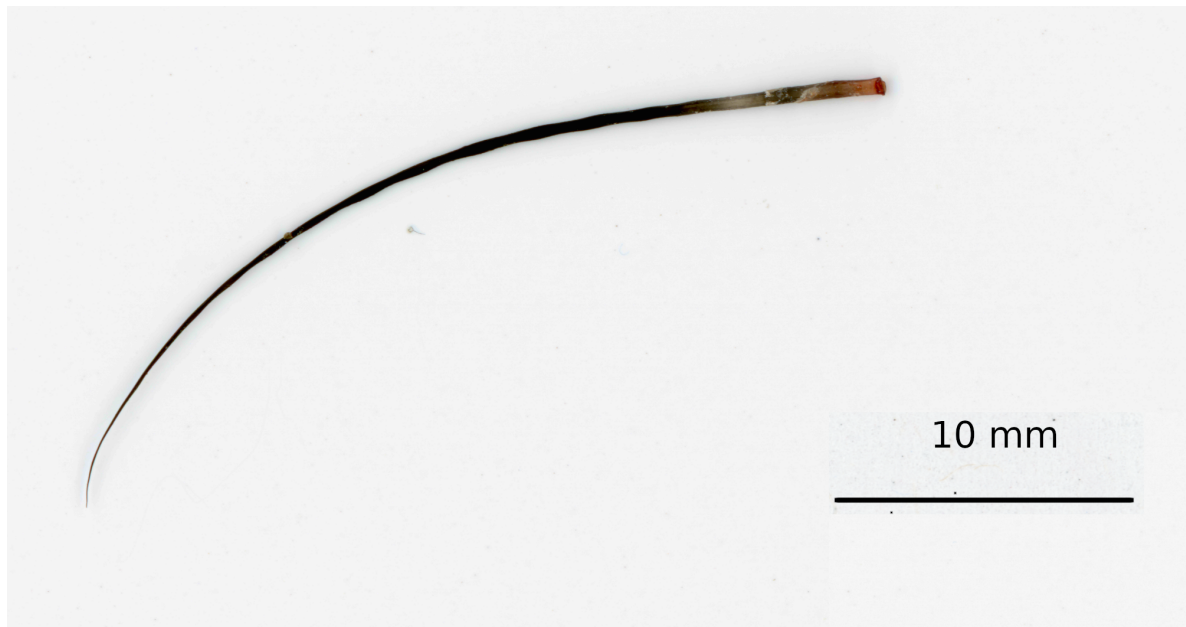
7.2. Grey seal (Halichoerus grypus)

Figure 16. A scan of a grey seal whisker. The whisker was scanned at a resolution of 2.646 microns per pixel.
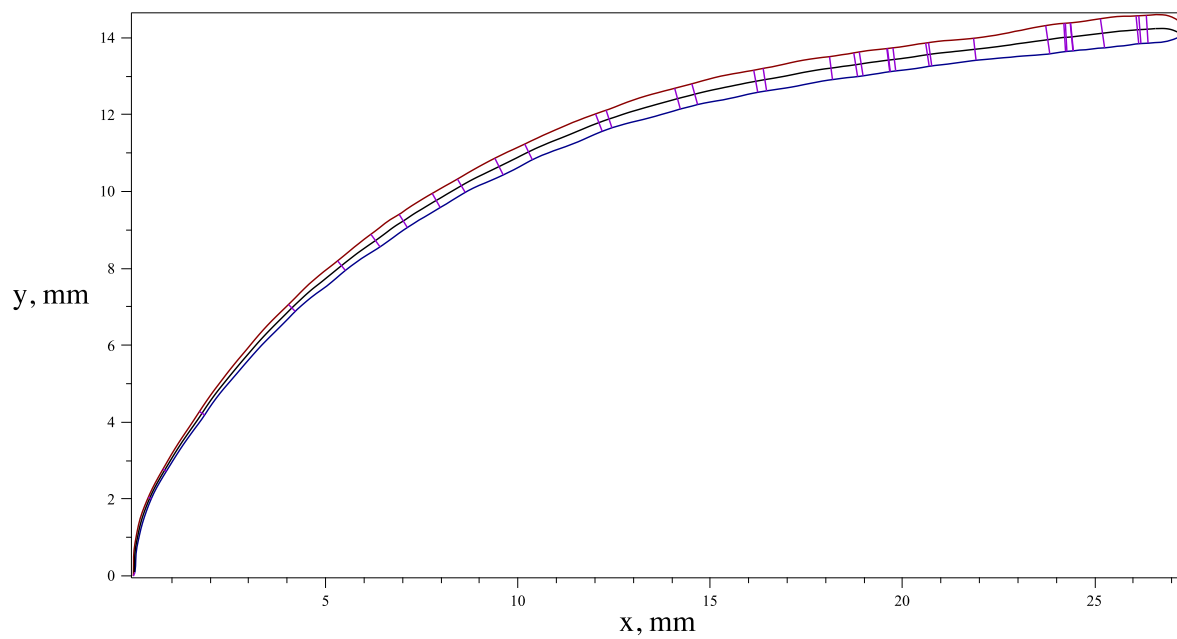

Figure 17. Normal centreline (black) for a grey seal whisker. Minimal chords are shown violet.
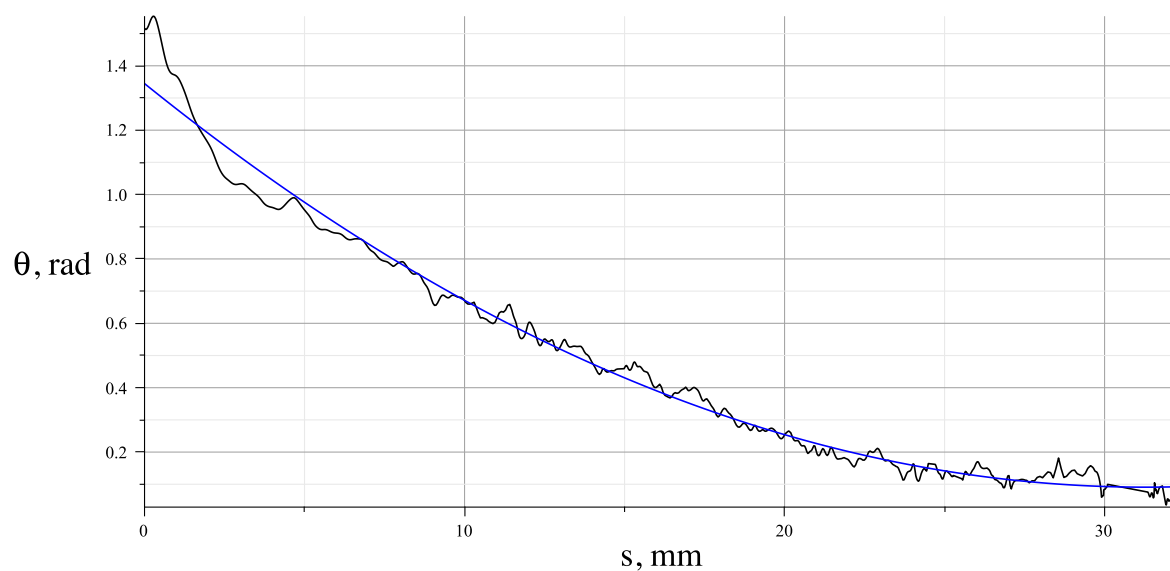
Figure 18. The tangential angle θ for the normal centreline as a function of the arclength s for a grey seal whisker. The second-order polynomial linear fit $\bar{\theta}(s) = 1.345 - 0.801 \cdot 10^{-1}s + 0.128 \cdot 10^{-2}s^2$ is shown in blue ($R^2 = 0.986$).
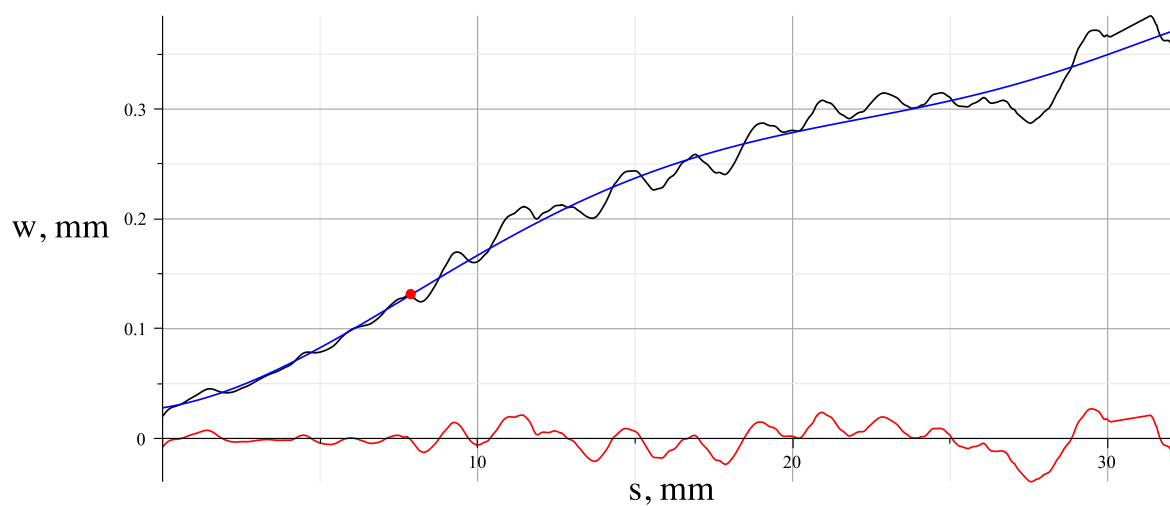

Figure 19. Half-width w as a function of the normal centreline length s for a grey seal whisker (black). The fourth-order polynomial linear fit $\bar{w}(s) = 0.280 \cdot 10^{-1} + 0.464 \cdot 10^{-2}s + 0.156 \cdot 10^{-3}s^2 - 0.470 \cdot 10^{-3}s^3 - 3.076 \cdot 10^{-4}s^4 + 1.696 \cdot 10^{-7}s^5 - 2.163 \cdot 10^{-9}s^6$ is shown in blue ($R^2 = 0.986$). The red dot marks the inflection of the polynomial function at the arclength $s^\star = 7.89$ mm about one third (0.24) of the full length. The red curve shows the oscillation amplitude of the half–width (the difference between the black and blue curves $\Delta w(s) = w(s) - \bar{w}(s)$).
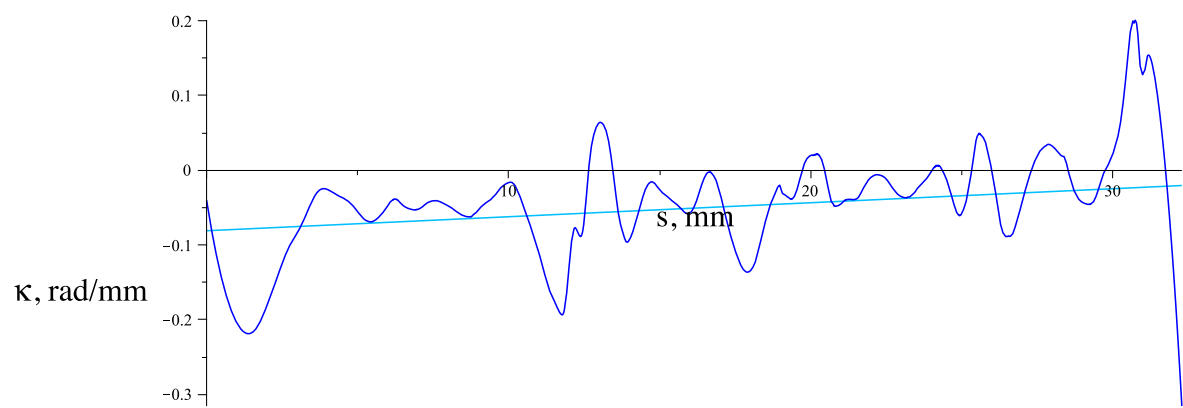
Figure 20. The smoothed curvature $\kappa(s)$ (blue) of the normal centreline, the first-order polynomial linear fit $\bar{\kappa}(s) = -0.811 \cdot 10^{-1} + 0.187 \cdot 10^{-2} s$ (light blue).
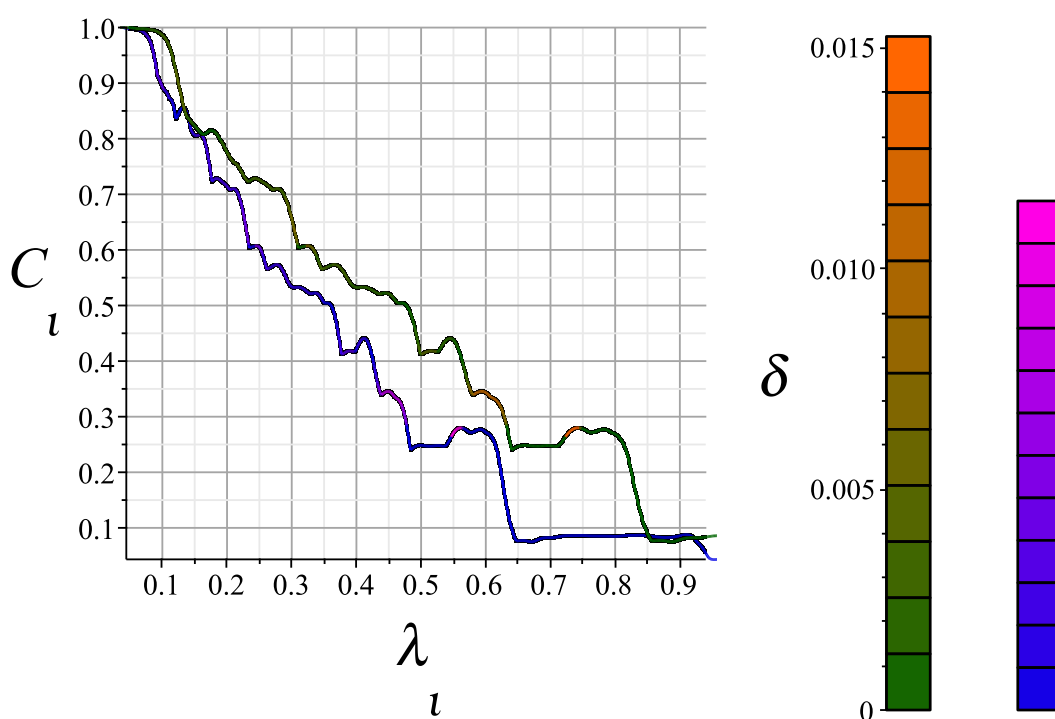

Figure 21. Width-curvature correlation coefficients $C_\iota(\ell)$ as functions of the fraction λ_ι of the correlation maximising whisker length interval to the full length ($\lambda_1 := \ell/L$ for $\iota = 1$, blue-magenta) and to the oscillation interval ($\lambda_2 := \ell/(L - s^\star)$ for $\iota = 2$, green-orange). The colour encodes the relative shift $-\delta$ along the arclength that corresponds to $C_\iota(\ell)$.
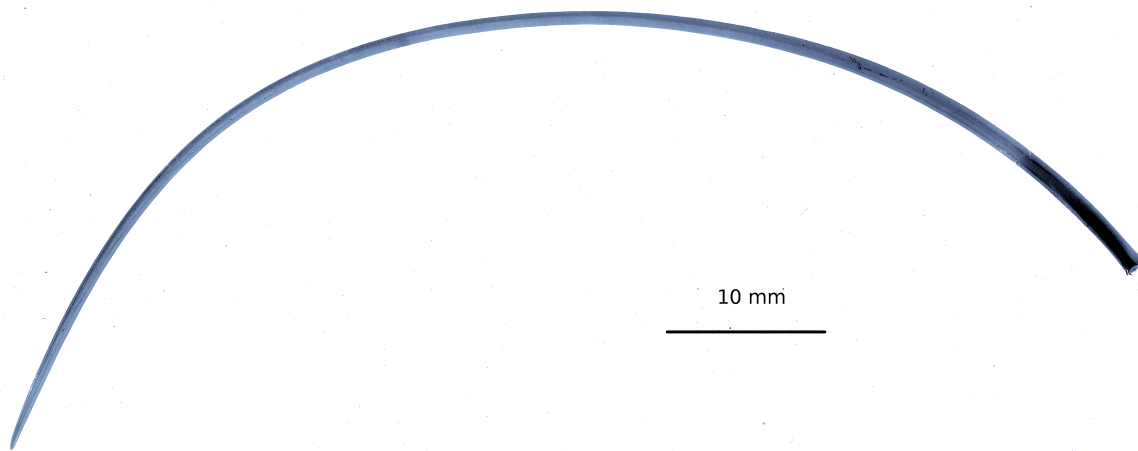
7.3. California sea lion (Zalophus californianus)

Figure 22. A scan of a california sea lion whisker. The whisker was scanned at a resolution of 5.292 microns per pixel.
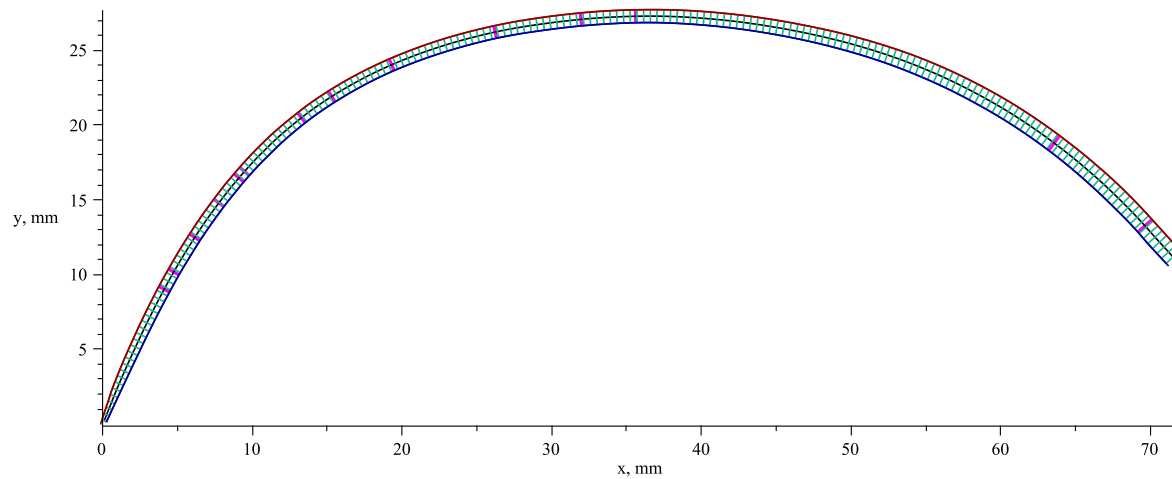

Figure 23. Normal centreline (black) for a california sea lion whisker. Normal chord are shown green and minimal chords violet.
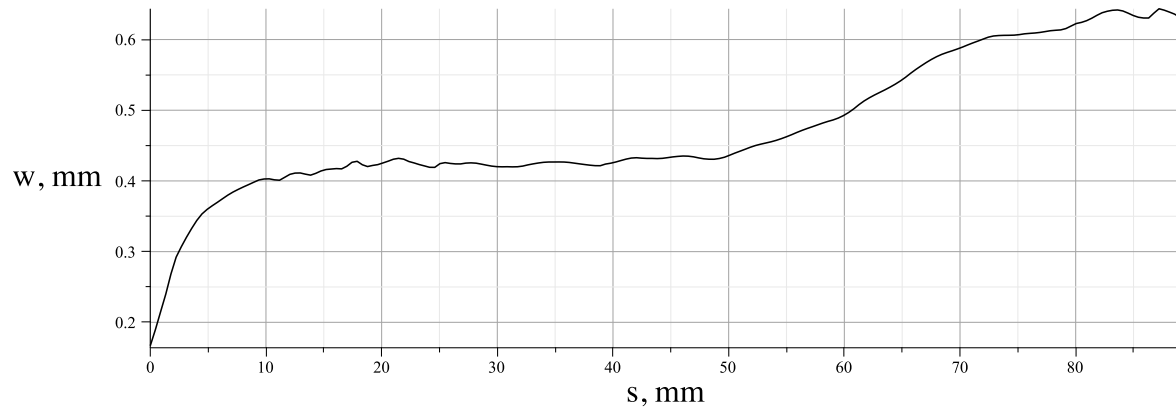
Figure 24. Half-width w as a function of the normal centreline arclength s for a california sea lion whisker.