NOTE ON WIRE-ANGLE IN OCEANOGRAPHY

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Recently Watson[1] made known an interesting experiment performed at the David Taylor Model Basin of the U. S. Navy. His experiment showed that a cable inclined to a horizontal stream experiences mainly a force which is normal to the cable. This agrees with experiments performed in the laboratory of the Oceanographic Institute, Gothenburg.[2]

In my paper,[3] the basic equations were established by assuming that the stress is horizontal and equal to that on the vertical projection of the cable. According to the experiments of Watson and Kullenberg my assumption does not hold and therefore the accuracy of the derived corrections of depth must be questioned.

The component of force acting at right angles to the wire element is equal in both cases, but in my assumption of 1951 an additional component acting along the direction of the wire was introduced. This leads to an expression of the angle between the wire and the horizontal (see Mosby, 1952: 4, formula 1) which can readily be integrated. On Watson's assumption the corresponding expression becomes

$$\tan \alpha = \frac{(m + s)\ p - \eta\, f\, v^2 \int_0^s \sin^2 \alpha \cos \alpha\, ds}{\eta\, f\, v^2\, (\eta + \int_0^s \sin^3 \alpha\, ds)},$$

which is not easy to handle. However, there is no difficulty in performing numerical integration in both cases. This has been done for a wire 1000 m long towed at 50 and 100 cm/sec respectively (examples illustrated in Mosby, 1952: fig. 7). It was found that the lead and

[1] Watson, E. E. 1953. An experiment to determine the hydrodynamic forces on a cable inclined to the direction of flow. Mar. Res., *12* (3): 245–248.

[2] Kullenberg, B. 1952. Sur la résistance à l'avancement d'un cylindre dans une eau courante si le cylindre forme un angle aigu avec la direction du courant. Cah. Cen. Recher. Ét. Océanogr., No. 5.

[3] Mosby, H. 1952. Wire-angle in Oceanography. Årb. Univ. Bergen, Naturv. Rekke Nr. 2: 1–26.

the lower end of the cable would reach greater depths according to my assumption when the same value was used in both cases for the resistance coefficient $\eta = 0.00087$. In the case of Watson's assumption, if this value is reduced by about 7% (or if the speed of towing is reduced by about 3%), then his and my assumptions lead to nearly identical results. For practical purposes corrections of depth will usually be determined from the wire angle at the surface; such corrections will then be practically independent of the basic assumption.