"Dragged Wave" Generated by a Line Segment Source: Analyses and Experiments on the Wave Pattern Staying around a Line Segment Source

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Appearance of a wave pattern staying around a stationary object in water current is a same phenomenon as a wake advancing with a moving object in still water such as Kelvin wave following a ship. They are named Dragged wave. Literatures explain Kelvin wave as a wake associated with a point wave source. We expanded a point source to a line segment source and investigated mechanism to form Dragged wave and relation between the wave pattern and conditions of water current. The crest lines of Dragged wave seen on a weir in a river near our school curve and disappear at a certain place. Moreover, the interval of crest lines varies by water flow rate. Using the geometrical method to draw figures of Dragged wave pattern, we found that Dragged wave on the weir is generated by the front line of weir which functions as a line segment source and intervals of crest lines correspond to the wavelength whose phase velocity is the same as the water flow velocity. By performing actual measurement, we confirmed that the values of the interval, curve and disappearance of crest lines are the same as predicted analytically. Dragged wave generated by a line segment source is often seen clearly not only on the weir but also at many other places. We got a general and detailed understanding about Dragged wave and performed experimental verification. This research will be applied to reduce wave resistance of a ship and noncontact measurement of water flow velocity.

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