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The hyperbolic problem

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Mooring lines in the Ocean might be seen as a pretty simple seamanlike activity.
Connecting valuable scientific instrumentation to it transforms this simple activity into a sophisticated engineering support which needs to be accurately designed, developed, deployed, monitored and hopefully recovered with its precious load of scientific data.
This work is an historical travel along the efforts carried out by scientists all over the world to successfully predict mooring line behaviour through both mathematical simulation and experimental verifications. It is at first glance unexpected how many factors one must observe to get closer and closer to a real ocean situation.
Most models have dual applications for mooring lines and towed bodies lines equations.

Numerous references are provided starting from the oldest one due to Isaac Newton.
In his “Philosophiae Naturalis Principia Matematica” (1687) the English scientist, while discussing about the law of motion for bodies in resistant medium, is envisaging a hyperbolic fitting to the phenomenon including asymptotic behaviour in non-resistant media.

A non-exhaustive set of mathematical simulations of the mooring lines trajectory prediction is listed here-under to document how the subject has been under scientific focus over almost a century.

Pode (1951) Prior personal computers diffusion a tabular form of calculus of cable geometry was used by generations of engineers keeping in mind the following limitations and approximations: tangential drag coefficients were assumed to be negligible. A steady current flow was assumed as in the towed configuration.

Cchabra (1982) Finite Element Method that assumes an arbitrary deflection angle for the top first section and calculates equilibrium equations down to the sea floor iterating up to a compliant solution.

Gualdesi (1987) ANAMOOR. A Fortran Program based on iterative methods above including experimental data from intensive mooring campaign. Database of experimental drag coefficients obtained in wind tunnel for the instrumentation verified in ocean mooring.

Dangov (1987) A set of Fortran routines, due to a Canadian scientist, to analyse discrepancies between model and experimental data due to strumming effect on mooring line. Acoustic Doppler Current Profiler’s data were adopted for the first time as an input for the model.

Skop and O’ Hara (1968) Static analysis of a three dimensional multi-leg model

Knutson (1987) A model developed at David taylor Model basin based on towed models.

Henry Berteaux (1990) SFMOOR Iterative FEM analysis fully fitted with mooring components data base developed by a WHOI scientist.
Henry Berteaux (1990) SSMOOR Same model applied to sub-surface moorings.

Gobats and Grosenbaugh (1998) Fully developed Method based on Strip Theory developed by WHOI scientists. Experimental validation results are not known.