bility resulting from this cause may be called the moment of hydrodynamical stability, as being dependent on the mo­tion of the body in the fluid, that is, on the relative motion of the fluid. This does not agree with the usual definition of hydrodynamical stability adopted by writers on naval ar­chitecture, as that also involves the elements of the hydro­statical stability in its terms ; but it is thought that keeping each moment of stability distinct, by referring it wholly to its own generators, tends to simplify the consideration of them ; and also, the explanation of the principles on which the height of the centre of effort of the sails depends may by the same means be divested of some obscurity.

Now, when, by the action of the wind on the sails, motion is communicated to a vessel from a state of rest, at first the effort of the wind on the sails is much greater than that of the water on the hull, and by the effect of the excess the velocity of the vessel is accelerated : but the velocity with which the wind acts on the sails is diminished in proportion as the velocity of the vessel is increased, therefore also the force with which it acts on them is gradually lessened : but as the velocity of the vessel increases, the resistance the water opposes to its motion is also increased ; consequently the two forces, the effort of the wind on the sails, and the resistance of the water on the hull, will ultimately become equal to each other ; and as they act in opposite directions, the vessel will, by the laws of motion, continue to move uni­formly in the direction of its course with the last acquired velocity; and this velocity will be in proportion to the mov­ing force, that is, to the force of the wind and the area of sail exposed to its action, or, if the force of the wind be sup­posed constant, will be in proportion to the area of the sail.

From what has been before said, it is evident that the moment of sail must be in proportion to the stability of the ship ; and since the velocity will be in proportion to the area of sail exposed to the action of the wind, the height of the centre of effort of the sail should be determined from the consideration of acquiring the greatest effective area of sail of which the powers of the ship will admit.

Bouguer, from reasoning on the facts which have been explained, which arc, that when a ship has acquired an uni­form velocity in any direction, the action of the wind on the sails to propel her in that direction becomes equal to the re­sistance opposed to her motion by the water, and that the moment of the resistance, calculated from the centre of gra­vity or of rotation, that is, the moment of hydrodynamical stability, subtracted from the moment of the action of the wind on the sails, estimated from the same point, will give the force by which the ship is inclined, conceived the idea that the sails of a vessel might be so disposed that she should maintain the same vertical position when under sail as when at anchor. This he proposed to effect by adjust­ing the sail in such a manner that its centre of effort should be situated in a point, which he has named the “ *point re­lique,”* and which he describes as being such, that when the centre of effort of the sails coincides with this point, the moment of the force of the wind to incline the ship will be wholly destroyed by the moment of hydrodynamical stabi­lity. But such an arrangement of the sail is not practically applicable to the cases in which the direction of the action of the force of the wind is oblique to that of the course of the vessel ; for, from the small proportion which the breadth of a vessel bears to her length, the moment of hydrodyna­mical stability will, under these circumstances, be less than when the directions of the wind and of the ship’s course co­incide, while the resultant of the effort of the wind will act at the same height above the centre of gravity of the ship in either case ; therefore Bouguer only insists, that since the moment of the hydrodynamical stability cannot, consistently with other circumstances, be made to destroy the whole of the effort of the wind to incline the ship, care should be taken that these two forces should be so proportioned to each other, that a sufficient moment of hydrostatical stabi­lity may be acquired to resist the excess of the moment of the wind on the sails over the moment of hydrodynamical stability, without too great an inclination of the ship.

But when the direction of the wind coincides with that of the course of the vessel, it is of great importance that the change from a state of rest to one of motion, or rather from one velocity to another, should be performed without any longitudinal inclination towards either extremity, and that the vessel should preserve that seat in the water which has been determined as most advantageous with reference to the longitudinal position of the centre of effort of the sails.

The course of reasoning which Bouguer has pursued to determine the position of this point involves suppositions which are at variance with the facts attendant on a vessel’s motion through the water, and therefore the conclusion at which he arrives is erroneous ; still, as an elucidation of the principle, his method may be advantageously explained.

He supposes DH (fig. 6) to be the direction of the re­sultant of the direct and vertical resistances experienced by the fore-part of the vessel AEFB, moving in the direction AB; and the line SK to be the direction of the resιdtant of the whole force of the wind acting on the sails. Let it meet DH in N. Now since, when the ship has acquired an uniform velocity, the forces which oppose the motion are equal to those which produce it, and as these forces act horizontally and destroy each other, the forces which re­main must be vertical. Take NR and NP to represent in quantity and direction the force of the water on the bows, and of the wind on the sails ; then complete the parallelo­gram NRTP, and join NT ; NT will represent, in quantity and direction, the force remaining after those parts of the forces NR and NP, which are equal and opposite, are de­stroyed ; and therefore NT will act in a vertical direction to lift the ship. But though this will be the direction of the action of NT on the vessel, its effects may also be to produce a rotatory motion round her centre of gravity. This will depend on the position of the point N, the inter­section of SK and DH. If we suppose the direction DH to be constant in position, and SK to vary in position ac­cording to the height of the sails, we shall see, that when the masts and sails are high, the direction SK will cut the direction DH at a point near the stern ; and therefore the action of the force NT taking place so near one extremity of the vessel, and one side of the centre of gravity, will tend to immerse the opposite extremity. On the contrary, if the masts and sails are low, the direction SK will inter­sect the direction DH more near to the bows of the ship, and the action of NT being before the centre of gravity, will raise the fore and immerse the after part ; and this in­