Jubilee prize competition

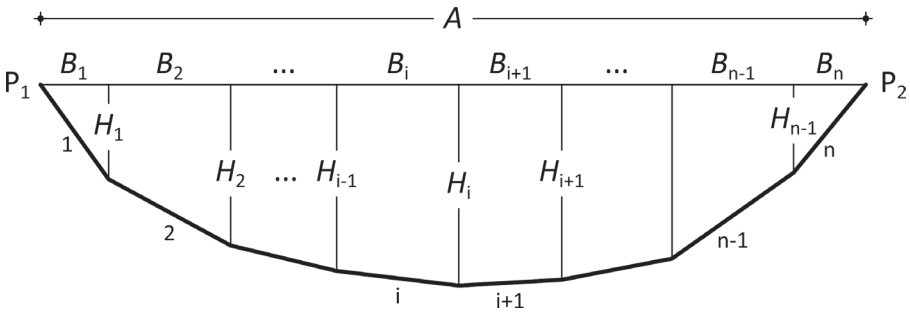
On the occasion of the 20th recurrence of the Christmas prize competition of the journal STAHLBAU, the jubilee is celebrated by presenting a problem which is more challenging than usual, and by establishing a **total prize of**

10 000 Euro

If more than one correct and complete solution is received, the prize is split among the winners according to the order in which the solutions are received: The second sender will get half as much as the first one, the third sender will get one third of what the first one gets, etc.

The problem:
It is assumed that a mass point is moving along a path which lies in a vertical plane and consists of a sequence of straight lines as shown in the figure. The path leads from the starting point P_1 to the terminal point P_2. These two points are positioned on a horizontal straight line and have the distance A. The starting speed of the mass point is zero and any changes of the speed are caused exclusively by the influence of the gravitation. At the corners of the path, the absolute value of the speed remains constant.

The positions of the corners must be determined so that the time T to move along the path from P_1 to P_2 gets a **minimum**.



Given:
A distance of points P_1 and P_2
n number of straight lines
g gravitation constant

Requested:
The explicit and exact analytic formulas for:
– the widths B_i (i = 1 … n),
– the heights H_i (i = 1 … n–1) and
– the minimal time T,
each dependent of given values;
– the evidence that for any value of n the relevant minimum conditions $\partial T/\partial B_i = 0$ and $\partial T/\partial H_i = 0$ are satisfied.

Add-on (irrelevant for the award decision):
Graphical construction of the path using only two constants which are obtained directly from A and n.

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Rotherstraße 21, 10245 Berlin,
Karl-Eugen.Kurrer@Wiley.com.

The solution and the names of the winners will be published in STAHLBAU 4/2016.

Author of the problem:
Em. o. Prof. Dr. *Helmut Rubin*,
TU Wien, Institute 202

Questions about the task may be sent to e-mail address:
helmut.rubin@aon.at.