Aalto University School of Science
Department of Mathematics and Systems Analysis Korte

MS-C1350 Partial differential equations, fall 2020

Pre-lecture assignment for Tue 24 Nov 2020

Please answer YES or NO, unless otherwise stated.

1. d'Alembert's formula for the Cauchy problem for the one-dimensional wave equation gives

   (a) existence of a solution.

   (b) uniqueness of a solution.

   (c) stability of a solution on the boundary data.

   (d) C^∞-smoothness of a solution.

2. Consider d'Alembert's solution for the Cauchy problem for the one-dimensional wave equation.

   (a) The solution at the point (x,t) depends only on the initial data on the interval $[x-t, x+t]$.

   (b) The initial data at x_0 affects the solution only in the cone which lies between the lines $x_0 = x - t$ and $x_0 = x + t$.

   (c) If the boundary data vanishes for $|x| > R$, then the solution vanishes for $|x| > R + t$.

   (d) If the initial speed is zero, then the solution at the point (x,t) depends only on the initial displacement at the points $x - t$ and $x + t$.

3. Consider d'Alembert's solution for the Cauchy problem for the one-dimensional wave equation. A disturbance of the initial data near the origin influences the solution at a point $x \neq 0$

   (a) forever starting at a certain moment of time.

   (b) from the initial moment until a certain moment of time after which it does not have any influence.

   (c) for a short moment of time starting at a certain moment of time.

   (d) forever starting at the initial moment of time.

4. (a) The Euler-Poisson-Darboux equations are for integral averages of the function instead of the function itself.

   (b) A solution to the Cauchy problem for the wave equation can be obtained as a limit of the solutions Euler-Poisson-Darboux equations.

   (c) d'Alembert's formula is used in the derivation of the Kirchhoff's formula.

   (d) The solution given by the Kirchhoff formula at a point (x,t), with $x \in \mathbb{R}^3$ and $t > 0$, depends on the initial data in the whole space.

5. Consider the Cauchy problem for the wave equation in the three-dimensional case. A disturbance of the initial data near the origin influences the solution at a point $x \neq 0$

   (a) forever starting at a certain moment of time.

   (b) from the initial moment until a certain moment of time after which it does not have any influence.

   (c) for a short moment of time starting at a certain moment of time.

   (d) forever starting at the initial moment of time.