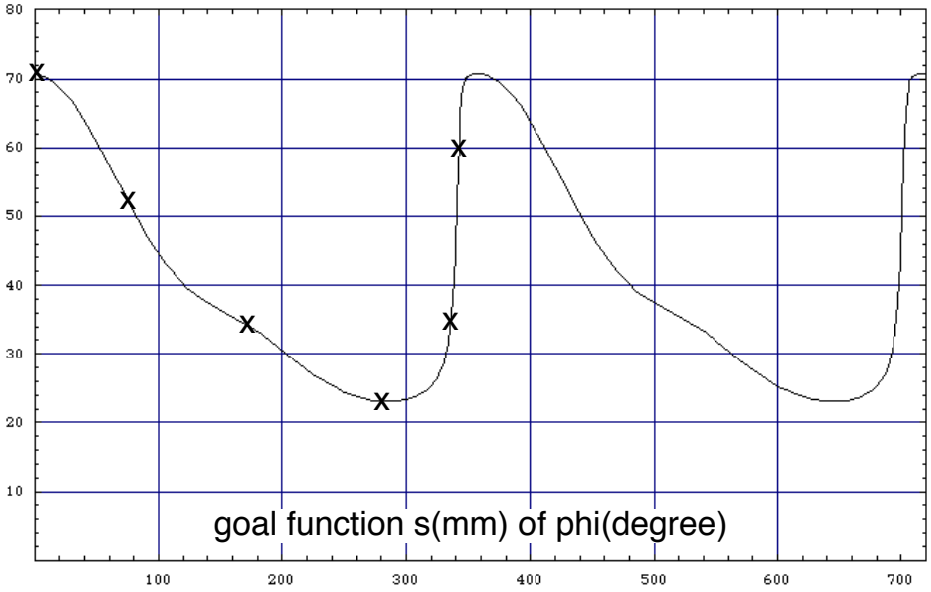
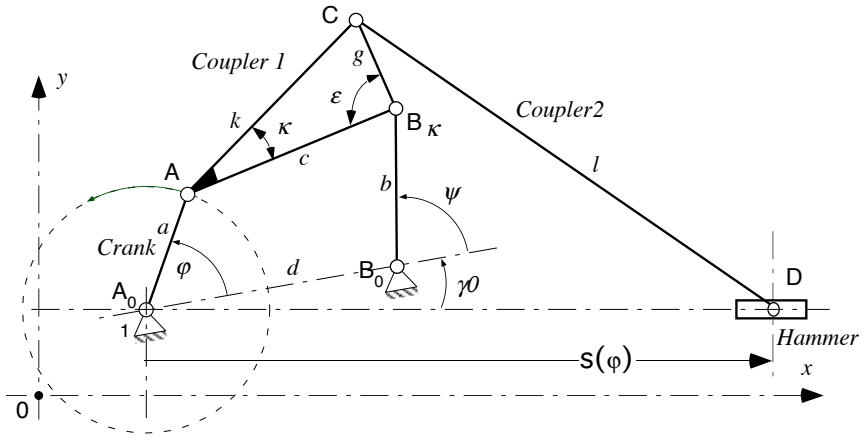
**MFB470 - MDA - SS 2009 - Prof. Dr. O. Wallrapp**
**Project 1 – Problem 3 – Date of issue 21.0509, Hand over 09.06.09-18:00 o'clock.**

*Description of Problem:* **Hammer Drill Drive**
**System-Input:** Crank motion **System-Output:** Hammer movement

The figures show first the goal function s(φ) of a hammer drill, that have a steep elongation after a crank angle φ of 320 °. It leads to a high velocity and high impact of the hammer. The hammer with hinge D is driven by a coupler CD and a pre-attached crank-rocker mechanism $A_0ABB_0$ with an extra arm for a hinge in point C.
The crank (input) $A_0A$ drives the mechanism and has a rotational speed of 300 Rev/min. The hammer has a mass of 80 g.




Solve: <*proposed credit points*>
1) <4> The type of mechanism is given, but find initial parameters to drive the hammer.
2) <28> Find the final corresponding parameters of the mechanism for a set of given values of the goal function.
   a) by a graphical method to find point C of the coupler ABC, use the relative consideration of coupler, (take 2 significant relative states w.r.t. a position 1 of the mechanism),
   b) verify the results by a numerical solution (using any Math programs) (or opposite);
   c) with the results check all the requirements and
   d) find the errors of the solution, check Grashof criteria

Note: Given are: $A_{0x} = A_{0y} = 0$, $\gamma_0 = -15.5241$ °, d = 18.6815, a = 16.5, b = 17, c = 19 mm, slider axis = x-axis.

3) <6> Derive the equations of the hammer point D as function of the crank angle $\varphi$ and compare it with the goal function.
4) <6> Find the functions for toggle angles, transmission angle, etc. and plot it.
5) <6> Find the function of the hammer velocity $v_D$ as function of the crank angle $\varphi$ and compute the linear momentum of the hammer.

## Basic Restrictions:

1) Write the following header on the top of the report and all the files:

**MFB470-MDA-SS2009-Project1** **Problem 3 - Group xx**

| Personal No. o List | Fam. Name | First Name | Stud. Group | Mat.-No. |
|---|---|---|---|---|
| | | | | |

Please add lines for each user of the group.

2) A group has maximum 2 persons. The groups are defined before handout and can not changed later.

3) I want to get a report in paper form, simple fixed. The report contains definition of the project (task), derivation of equations, drawings, diagrams, main results.
Handwriting is possible. One group has one report.
Hand over must be in time and in the post case near the faculty office.

4) Additionally, I want a folder (compressed by zip) containing all files of mathematical calculations done by math programs send by mail to Wallrapp@hm.edu.
**Mail-Subject**: MDA_Pro1_Problem3_Groupxx << very important.
**File-Name:** MDA_Pro1_Problem3_Groupxx.extension << very important -
other files are not accepted!
Never use "Umlaute" in the text and file name !!!

5) The project is a part of the exam in MDA and will be valid by points / later by a mark. Each user in a group will get the same mark. The proposed points are given in the task description. The maximum is 50 points.