Project LOG 02: Fishing for Force

The case-project makes use of the magnetic force of permanent (neodymium) magnets and electromagnetism.

With this part of the research, I want to determine the "sweet-spot" of the permanent magnets and the solenoid. What is the decrease of the magnetic force in relationship to the distance?

Stacking magnets increases the force of the magnetic field. What is the influence of stacking the magnets in relation to the weight.

Test-setup neodymium magnets:

For this experiment I used two rulers and placed them in a V-shape. I taped a magnet at the head end. In the V-shape was a small metal cylinder (D=14mm).

For the distance to the magnet I used persplex plates (1,8mm thick).

From the cylinder I had a string connected to a force meter (CMA CoachLab). The rulers and the cylinder were coated with teflon to reduce most friction.

Fig 1: Neodymium magnet taped to head end

Fig 2: persplex plates for distance

Fig 3:
CMA Force Sensor II

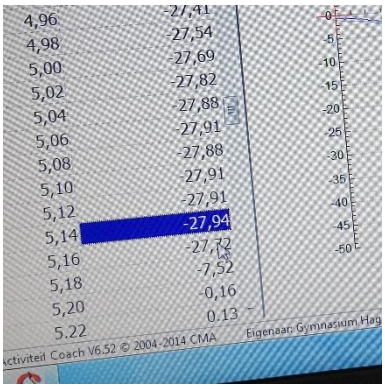


Fig 4:
CMA CoachLab

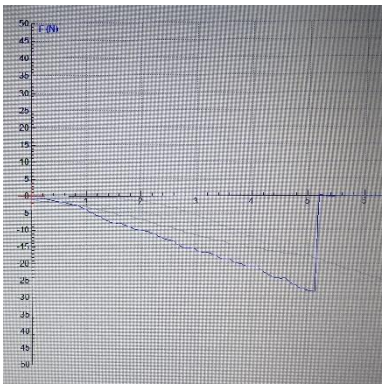
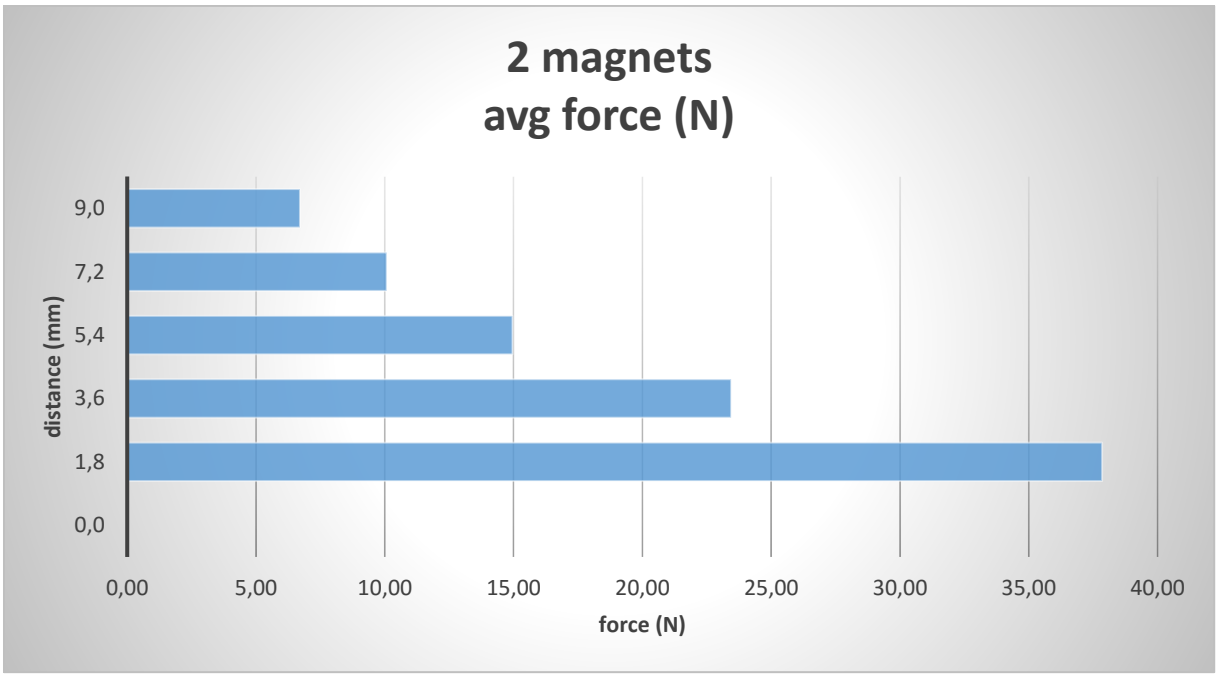


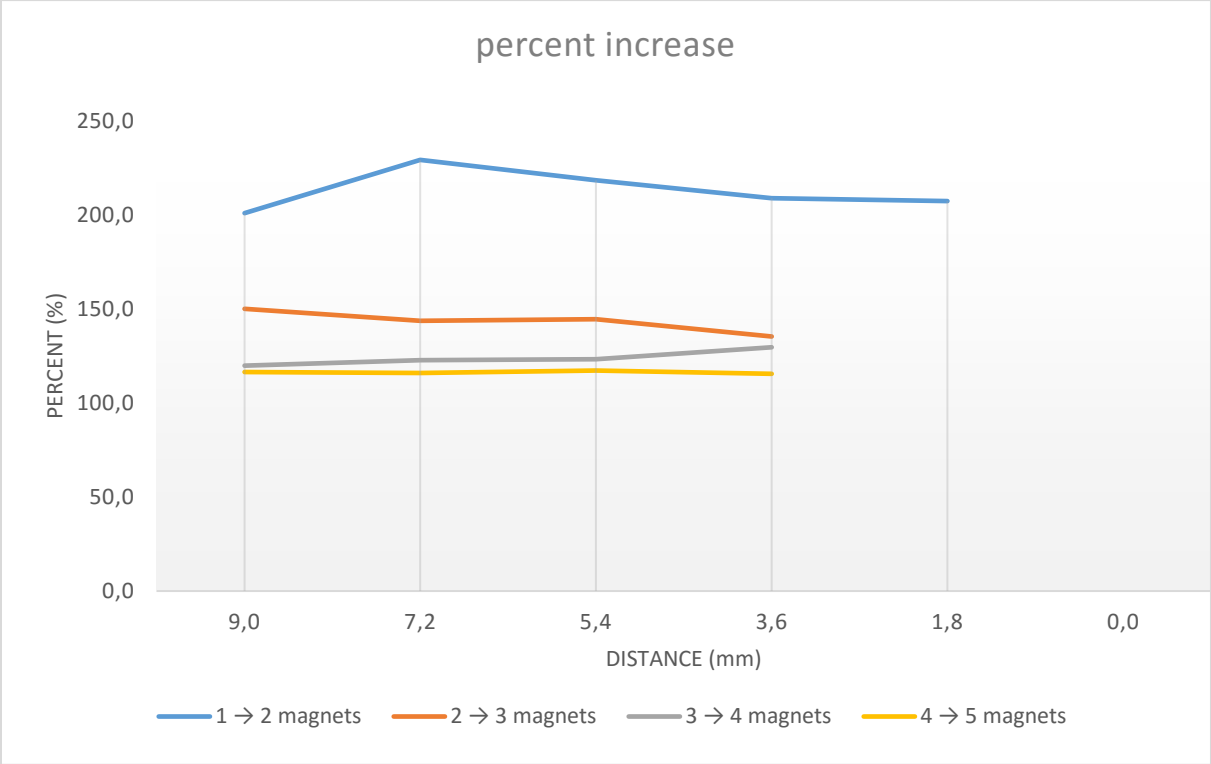
Fig 5:
CMA CoachLab

I tested with 1, 2, 3, 4 and 5 magnets on several distances (complete tables in the appendix)



Graph 1: Average force for 2 magnets (0.0mm exceeded the 50N-capacity)

The best result was with 2 magnets.



Graph 2: The percentage of the increase in power for stacked magnets

Decisions have to be made about the required power. About how much stress the pendulum will have to be able to handle.

Test-setup solenoid:

For this experiment I used the same two rulers in a V-shape. This time I placed a solenoid (0.65/600turns) at the end. On the forcemeter I installed a pvc rod. At the and of the rod I taped a neodymium magnet (18x3mm)

appendix

table 1: force for 1 magnet

distance (mm)	**test I** force (N)	**test II** force (N)	**test III** force (N)	**avg** force (N)
9,0	3,37	3,34	3,30	3,34
7,2	4,44	4,37	4,37	4,39
5,4	7,05	6,39	7,11	6,85
3,6	11,39	10,86	11,42	11,22
1,8	18,28	18,19	18,32	18,26
0,0	27,72	27,94	29,30	28,32

table 2: force for 2 magnets

distance (mm)	**test I** force (N)	**test II** force (N)	**test III** force (N)	**avg** force (N)
9,0	6,80	6,67	6,64	6,70
7,2	10,10	10,04	10,07	10,07
5,4	14,35	14,88	15,64	14,96
3,6	22,50	24,89	22,94	23,44
1,8	38,33	37,57	37,64	37,85
0,0	*na*	*na*	*na*	*na*

na: not available (exceeded the 50N-capacity)

table 3: force for 3 magnets

distance (mm)	**test I** force (N)	**test II** force (N)	**test III** force (N)	**avg** force (N)
9,0	9,72	10,35	10,10	10,06
7,2	14,79	14,66	13,96	14,47
5,4	20,77	22,41	21,68	21,62
3,6	34,89	35,03	25,25	31,72
1,8	*na*	*na*	*na*	*na*
0,0	*na*	*na*	*na*	*na*

na: not available (exceeded the 50N-capacity)

table 4: force for 4 magnets

distance (mm)	**test I** force (N)	**test II** force (N)	**test III** force (N)	**avg** force (N)
9,0	12,05	12,02	12,08	12,05
7,2	17,72	18,00	17,53	17,75
5,4	26,72	26,40	26,84	26,65
3,6	40,37	41,70	41,26	41,11
1,8	*na*	*na*	*na*	*na*
0,0	*na*	*na*	*na*	*na*

na: not available (exceeded the 50N-capacity)

table 5: force for 5 magnets

distance (mm)	**test I** force (N)	**test II** force (N)	**test III** force (N)	**avg** force (N)
9,0	13,91	14,07	14,10	14,03
7,2	20,99	20,17	20,55	20,57
5,4	31,59	31,09	31,06	31,25
3,6	48,53	46,57	47,33	47,48
1,8	*na*	*na*	*na*	*na*
0,0	*na*	*na*	*na*	*na*

na: not available (exceeded the 50N-capacity)