HW 2

1.

a) link to my GitHub repository: https://github.com/jhalkola/funSTA. The program will print in terminal the answers to **a** and **b** (also answered text parts here).

b) sum-of-squares error turned out to be 0.030335149735074885. It did not go to zero but got to fairly low error overall. Reasons could be for example that the sensor just cannot be calibrated better but also that the ”groundtruth” can be also be flawed as there is no perfect sensor. Our method can also be flawed as there can be other factors that affect the sensor reading thus mapping only acceleration stimulus to the measurement may not give perfect result.

c) Corrections on offset were mainly done in the first and second axis where the first one had a some reductions done and the second one had slight additions to the readings.

scale had around 0.9 correction on each axis while only minor corrections to the rotation were done.

2. **a) Radar:**

Active, it needs electricity to create electromagnetic waves.

Complex, as it needs something to procude the waves but sensors in them sense the signal.

Global, radars can be used for long distances

absolute, radar signal is produced in reference to distance

b) Electron microscope:

active, needs electricity to work

complex, uses beam of accelerated electrons for illumination and camera

local, only in very close proximity

absolute, stimulus is referenced to the velocity at which electrons are accelerated

c) Magnifying glass:

not a sensor as it does not produce any electric signal

d) Smoke detector:

Passive, it can use photodiode to produce electric signal from light, battery inside of smoke detector is used for alarm system

Complex, photodiode first converts light to produce electric signal

Could be fairly global as the detector could detect smoke from far away but of course always used in local conditions

relative, photodiode absorbs photons to create the signal, this is not referenced to any scale

e) The Large Hadron Collider

active, needs power to collide the particles

complex, converts collision energy to electricity (plainly speaking)

local, stimulus only considered at a specific location of the collider

absolute, signal is produced by acclerating the partical thus it is based on velocity/acceleration

f) Metal detector

active, use current that passes through a coil, creating magnetic field which is used for detection

complex, needs magnetic field to produce the signal and uses sensor to detect the change in the field for sensing if a metal is near

local, only for very close proximity uses

relative, magnetic field of the location can affect the detector

g) Pocket radio

not a sensor, as it uses electricity as stimulus but does not electric signal. Sound are pressure waves in the air which are not electric.