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KTH Mekanik

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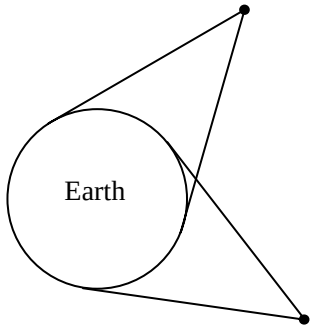
5C1106 Tillämpad fysik, mekanik, 4 poäng (6 ECTS)

Projekt: Stationära satelliter

Permanent communications links between different parts of the world can be established by putting relay satellites into stationary orbits around the earth.



Although, the word stationary is used, the satellites are not at rest. If the center of the earth is considered as a fixed point then a satellite can be considered to move in a circle about this point. However, of course, the earth is spinning on its axis so that if the satellite and a point on the earth's surface have the same *angular* speed then the satellite remains above that point. To an observer the satellite appears stationary. Signals from one transmitting station on the surface to the earth are the bounced off one or more satellites until they reach their destination.

To simply the situation you shall start with considering a satellite system to establish links between points on *the equator*, *i.e.* several satellites moving in the same circular (a further simplification) orbit above the equator.

For a single such satellite you need to consider:
1. What is the relation between the speed of a satellite and its height above the earth?
2. What then is the particular value for the height which gives a 'stationary' orbit (*i.e.* gives an orbiting period of 24 hours)?

Then, you must also determine
3. How many such satellites are needed to link each point on the equator to every other point

Consider also the efficiency in communicating via satellites and via terrestrial cables.

On a larger scale, the planets of the solar system are satellites of the sun. If you again simplify the situation by taking the planetary orbits to be circular, at constant speed, find how well does the observed data of the nine planets of the sun fit the relationships between period and radius of orbit.