Notes for lecture 4

1. Date: April 28th. Form: online class conducted over Zoom.
2. Reading: the lecture material is based on Sections 5 of Chapter 2 of the main textbook (refer to Chapter2.5.pdf file). An extra reference, explaining the same content, is provided for your convenience (see file ExtraReferenceToChapter2.5.pdf). Note that in the extra reference notation is slightly changed (angle θ instead of β , and unit vectors $\boldsymbol{u}_t, \boldsymbol{u}_n$ instead of $\boldsymbol{e}_t, \boldsymbol{e}_n$)
3. The lecture (see LectureNotes4.pdf file) communicates the following issues
    a. Normal and tangential velocity components of the velocity and acceleration vectors. The main differences (to what we studied in the last class) can be summarized as follows.
        i. A path (curve) along which a particle is moving is (explicitly or implicitly) presumed.
        ii. The position of the particle is measured with respect to this path (given by the path length). This path length is often called the natural coordinate and plays an important role in differential geometry.
        iii. Velocity and acceleration vectors are described not with respect to some fixed coordinate system but with respect to some coordinate system ($\boldsymbol{e}_t, \boldsymbol{e}_n$) that is moving along the path
    b. Radius of curvature of planar curves. This might be a new concept for you. Curves can flat or curved, but how to measure the degree of curvature? This is what radius of curvature is used for. In the class, we consider it for two cases:
        i. When the planar curve is represented in parametric form (by two formula for, respectively, $x = x(t)$ and $y = y(t)$, where t is a freely changed parameter)
        ii. When the planar curve is represented as a graph ($y = y(x)$). You do not need to memorize these formula, but you are requested to know how to use them. That is tested in practical problems.
4. Optional Ch2D.swf file in the Resources (same as before) is provided
    a. When playing the file please do not push Main Menu button; when returning please use Chapter Menu button.
    b. The content of Ch2D.swf file relevant to this lecture (yellow text corresponding to Coordinate Systems-> Two-dimensional->Normal-Tangential)
5. In understanding the presentation content and in solving practical problems,
    a. It is worth refreshing basic formulas for rectilinear motion (because the tangential motion employs similar ones)
    b. It is worth refreshing basic formulas for cross product of two vectors (because the derivation of the radius of curvature uses it)
6. The deadline for submitting assignment (see Quiz4.pdf) is May 12.