Comments on the litterature for the first lectures

Chapter 1 (Introduction) is beautifully written. Sections 1.3-1.5 provide nice rehearsal of basics.

Section 1.2 discusses when we are allowed to make the continuum approximation. Strictly speaking, matter is build up by atoms, and not at all continuous. For example, this means that density fluctuates wildly at microscopic scales. If we look for the density in a volume as big as an atomic nucleus, it will be huge if there happens to be a nucleaus in our volume, but zero if our volume is in the vacuum between atoms. If our test-volume to find the density is much larger than the typical volume around an atom, the result will be more independent of precisely where we put our volume, and the concept of density becomes meaningful.

For the continuum approximation to work, we must be able to construct test volumes (called **"material particles"** and discussed in section 1.3) large enough for properties like density to be meaningful, and yet have those volumes much smaller than the total system we study. This is similar to granular matter, build up by small grains. If the grains are much smaller than the system, we will observe smooth flows, but if the grains are roughly as big as the system, we can see effects of the grains themselves, for example when friction causes them to jam a pipe even though the opening is bigger than the grains themselves.

Section 1.6 introduces *fields*. **Page 15 and 16** are great reading, but page 17 is more philosophical and may raise more questions than it answers.

Appendix C is high priority in the beginning of the course! In particular C.1-C.4. Read these parts of appendix C carefully, treat every equation as an exercise (can you show that the equation is correct?). And *prepare questions* if there are things you find hard to understand.

We discussed that a vector field has to transform correctly, as is mentioned in C.5. We will later discuss *tensor fields* mentioned in C.5, but until then they will just be confusing, so skip them for now.

Integral theorems were made plausible, though not thoroughly proven. Note the similar structure to all of them: $\int_{\text{region}}(\text{derivative of something}) = \oint_{\text{edge}}(\text{the same something})$.

As a nice example of surface integrals, we took the powerful proof of **Archimede's principle** from **chapter 3.1**.