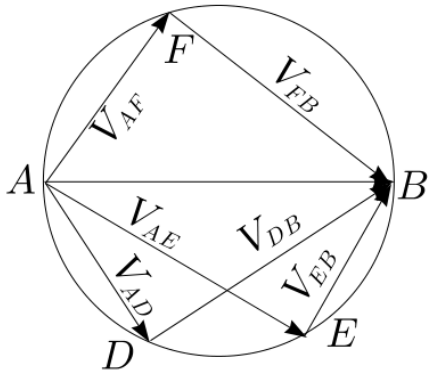
7. LCR-CIRCUIT

i) Let us consider first the upper branch of the circuit consisting of the capacitor C and resistor R_2. There is the same current I_1 through the both elements so that the complex voltage amplitudes are $I_1/(i\omega C)$ and $I_1 R_2$, respectively. Division by imaginary unit rotates a vector in complex plane clock-wise by $\pi/2$, hence the voltage vector on resistor is rotated with respect to the voltage on the capacitor counter-clock-wise by $\pi/2$. Similar analysis leads us to the conclusion that the voltage on the inductor L_1 is rotated with respect to the voltage on the resistor R_0 counter-clock-wise by $\pi/2$, and that the voltage on the resistor R_1 is rotated with respect to the voltage on the inductor L_0 clock-wise by $\pi/2$. The resulting phasor diagram is shown below.



ii) From Thales theorem we can conclude that the points F, D, and E in the figure above lay on the circle drawn around the segment AB as a diameter. Hence, the voltage V_{AB} which we want to know equals by modulus to the diameter AB of the circumcircle of the triangle FDE for which we know the side lengths. By making use of the two formulas for the surface area of a triangle, the Heron formula $A = \sqrt{p(p-a)(p-b)(p-c)}$, with $p = \frac{1}{2}(a+b+c)$, and $A = \frac{abc}{4R}$ with R denoting the radius of the circumcircle, we conclude that the diameter of the circumcircle

$$2R = \frac{abc}{2\sqrt{p(p-a)(p-b)(p-c)}}.$$

With $a = 7\,\mathrm{V}$, $b = 15\,\mathrm{V}$ and $c = 20\,\mathrm{V}$ we obtain $p = 21\,\mathrm{V}$ and $V_{AB} = 2R = 25\,\mathrm{V}$.