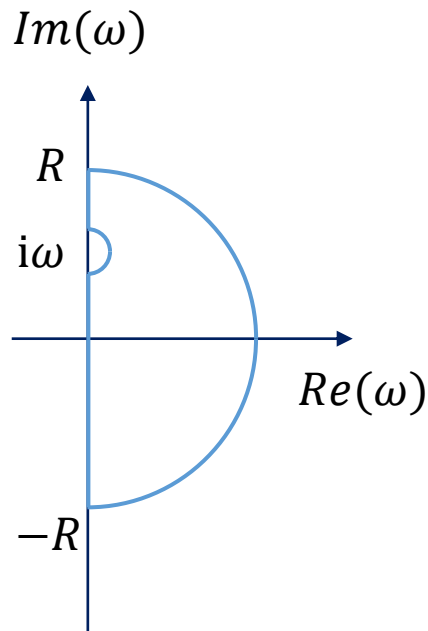


Fine name: NAME\_ID\_HW#, e.g. 홍길동\_20230101\_HW#

- Let  $X(\omega)$  be analytical on the right half plane. When  $R \rightarrow \infty$ ,  $X(\omega)$  goes to zero (faster than  $1/|\omega|$ ). Using the Cauchy's integral on the right half plane, prove  $\text{Re}(X(i\omega)) = -\frac{P}{\pi} \int_{-\infty}^{\infty} \frac{\text{Im}(X(i\omega'))}{\omega' - \omega} d\omega'$ . (Hint: Refer to the contour below and integrate with clockwise direction.)



- Griffiths Problem 9.26** [Group velocity ( $v_g$ ) 식까지만 유도하시오]

**Problem 9.26** Starting with Eq. 9.170, calculate the group velocity, assuming there is only one resonance, at  $\omega_0$ . Use a computer to graph  $y \equiv v_g/c$  as a function of  $x \equiv (\omega/\omega_0)^2$ , from  $x = 0$  to 2, (a) for  $\gamma = 0$ , and (b) for  $\gamma = (0.1)\omega_0$ . Let  $(Nq^2)/(2m\epsilon_0\omega_0^2) = 0.003$ . Note that the group velocity can exceed  $c$ .

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### 3. Griffiths Problem 9.36

**Problem 9.36** Light of (angular) frequency  $\omega$  passes from medium 1, through a slab (thickness  $d$ ) of medium 2, and into medium 3 (for instance, from water through glass into air, as in Fig. 9.27). Show that the transmission coefficient for normal incidence is given by

$$T^{-1} = \frac{1}{4n_1n_3} \left[ (n_1 + n_3)^2 + \frac{(n_1^2 - n_2^2)(n_3^2 - n_2^2)}{n_2^2} \sin^2 \left( \frac{n_2\omega d}{c} \right) \right]. \quad (9.199)$$

[Hint: To the *left*, there is an incident wave and a reflected wave; to the *right*, there is a transmitted wave; inside the slab, there is a wave going to the right and a wave going to the left. Express each of these in terms of its complex amplitude, and relate the amplitudes by imposing suitable boundary conditions at the two interfaces. All three media are linear and homogeneous; assume  $\mu_1 = \mu_2 = \mu_3 = \mu_0$ .]

- A. 연습문제를 푸시오.
  - B. 최대 투과의 조건은 빛이 수직이 아닌 각도를 가지고 입사할 때도 성립한다. 그 이유를 논하시오. (입사각과 편광을 고려하여 실제로 투과율을 구해서 보여도 되고, 정확한 수학적 해석 없이 논리적으로 설명해도 무방함)
- 
4. Group velocity larger than the speed of light  $c$ ? 첨부한 논문 (Physical Review A, vol. 48, number 1, 1993)을 읽고 다음의 물음에 본인의 논리를 적으시오.
    - A. Inverted system에서  $v_g > c$  를 만족하는 주파수 영역에 대해 논하시오.
    - B.  $v_g > c$  를 만족할 때 causality 위배 여부에 대해 논하시오.