**Homework 11**

**P21.3.4** Determine the LT of (a) the impulse train ; (b) a negative impulse train .

From the sum of these two LTs, deduce the Laplace transform of the square wave of Figure P21.3.1.

**Solution:** (a) The Laplace transform of the impulse train is  = .

(b) The Laplace transform of the negated and delayed impulse train is . The sum of the two is . If the impulse trains are of strength ±2*A* and are integrated starting at *t* = 0, the result is a square wave of amplitude 2*A* and average value *A*. Hence, to obtain the Laplace transform of the square wave of Figure 21.3.1,  must be multiplied by 2, divided by *s*, and  subtracted from it. The same result is obtained as in P23.3.1.

**P21.4.1** Determine the ILT of .

**Solution:**  =

; .

**P21.4.4** Determine the ILT of .

**Solution:**  multiplying by (*s* + 3)2 and setting *s* = -3, -2 = *K*1; cross multiplying, *s* + 1 = -2 + K2(s + 3); *k*2 = 1. The ILT is: .

**P21.5.1** If , determine *f*(*t*) as *t* → ∞.

**Solution:** Multiply by s and set *s* = 0. This gives *sF*(*s*) = 300/30 = 10 = *f*(*t*).

**P21.5.5** If , determine *f*(0+).

**Solution:** Dividing numerator by denominator, . Applying the initial value theorem to the proper rational function, *f*(0+) = -8.

**P21.5.7** A function *x*(*t*) when convolved with the function  gives the function . Determine *x*(*t*).

**Solution:** L; L= .

L*x*(*t*)×=; L*x*(*t*) = ; *x*(*t*) = .