CH402 Chemical Engineering Process Design

Class Notes L20

Review and Bonds

Finding the Present Worth of a Bond

A bond is a long-term note (essentially an IOU) issued by a corporation or governmental entity for the purpose of financing major projects. The borrower receives money now in return for a promise to pay later, with interest paid in between. The conditions for repayment of the money obtained by the borrower are specified at the time the bond is issued. These conditions include the bond face value, bond interest rate, and bond maturity date.

The bond face value refers to the denomination of the bond (typically $1,000). The face value is important for two reasons: (1) it represents the lump sum amount the holder will receive on the bond maturity date, and (2) it is used in conjunction with the bond interest rate and bond interest payment period to determine the interest per period the bond holder will receive prior to maturity. This interest received per period by the bond holder is calculated according to the following equation:

$$I = \frac{FV \cdot b}{n}$$

FV = face value
b = bond interest rate
n = number of interest payments per year
I = amount of interest paid each period in dollars

The present worth of a bond represents the amount of money now that is equivalent to the future income or payment stream associated with the bond: the interest, I, received each period and the face value. The bond interest represents a uniform series cash flow while the face value, V, represents a future single payment amount on the bond maturity date. The present worth of a bond can be determined by the following general equation:

$$PW_{bond} = I \cdot (P/A,i,n) + FV \cdot (P/F,i,n)$$

Definition: The interest is referred to as the "coupon."

Example

A municipal bond with a face value of $10,000 will mature 15 years from now. The bond interest rate is 6% per year, payable quarterly. If the market interest rate is 16% per year compounded quarterly, the present worth of the bond is closest to:

    (a) $4,173
    (b) $4,345
    (c) $5,277
    (d) $6,135

Solution: The first step is to calculate the bond interest paid per quarter. Then, use this interest as an A value and the single amount face value to determine the present worth at the market interest rate. The quarterly market interest rate is 16%/4 = 4% for 15(4) = 60 quarters.

$$I = \frac{FV \cdot b}{n} = \frac{10,000 \cdot 0.06}{4} = \$150$$

$$PW_{bond} = I \cdot (P/A, i, n) + FV \cdot (P/F, i, n)$$

$$= 150 \cdot (P/A, 4\%, 60) + 10,000 \cdot (P/F, 4\%, 60)$$

$$= 150 \cdot 22.6235 + 10,000 \cdot 0.0951$$

$$= \$4,344.53 \quad \text{(b)//ANS}$$

See review problems 11-18 for additional practice with bonds.

Questions?