RE-VALUATION OF SINKING FUND – AN EMPIRICAL VIEW

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Introduction:-

Civil Engineering and its alike branches have various professionals like valuers, designers, estimators, arbitrators, quantity surveyors & town planners etc. Every professional merged in practice needs, regular updating to cope with professional competency. Regarding so the valuers, estimators and quantity surveyors, especially merged in building profession have come in notice that while deciding & calculating a term, like sinking fund in quantity surveying or in valuation, the premium affixed by the earlier decided formula in my view ,does not stand accurate and precise. As sinking fund importantly comes in notice while valuation.

Finally in Sinking Fund, on the bases of maturity value, the amount of annual Premium is decided to deposit in bank accumulating compound interest on prevailing rates, for certain years, so as to get already decided maturity value.

For this since long, $\mathbf{I = Si/ (1+i)^n - 1}$ has been the formula in all books of Estimating Costing & Valuation & its related books up to now. Due to this concerns (valuers/ Estimators) are always using this formula in practice, after analysis and derivation empirically developed a revised new formula which is as below with usual and common notations.

$$\mathbf{Imkv = Si/ (1+i)^{n+1} - (1+i)}$$

Where :

Imkv	=	annual premium to be deposited in bank for certain years.
i	=	prevailing rate of interest of bank in decimal.
S	=	amount of sinking fund (already decided).
N	=	number of years to which annual premium is to be deposited.

Comparative Observation

For verification and confirmation of I, vis-à-vis Imkv an illustration with comparative is as under.

Suppose S= Rs 10000/., n=2 years, i = 4% annual interest = 0.04

Now the comparative form is being tabulated for observation:-

From the formula $I = Si/ (1+i)^n - 1$	From the new evolved formula by author ie mkv $Imkv = Si/ (1+i)^{n+1} - (1+i)$
$I = \frac{10000 \times 0.04}{(1+0.04)^2 - 1} = 4901.96 \sim 4902/-$ Hence the premium decided Rs 4902/-	$Imkv = \frac{10000 \times 0.04}{(1+0.04)^{2+1} - (1+0.04)} = 4713.423831$ Hence the premium finalized =Rs 4713.423831/-
Premium at the begining of first year M_1 = 4902/. Interest at the end of first year = I_1 = 196/-	Premium at the beginning of First year M_1 = 4713.423831/- Interest at the end of first year = I_1 = 188.5369532/-
At the end of year total = $M_1 + I_1$ = 4902+196/. = 5098/-	At the end of year total = $M_1 + I_1$ =4713.423831+188.5369532 = 4901.960784/-
Second Premium at the beginning of Second year = M_2 =4902/-	Second Premium at the beginning of Second year = M_2 =4713.423831/-
Hence Total deposits at the beginning up to second year = 5908+4902= 10000/-	Hence Total deposits at the beginning up to second year = 4713.423831+4901.960784 = 9615.384615/-
Interest at the end of second year I_2 = 400/- Total amount = 10000+ 400 = 10400/-	Interest at the end of second year I_2 = 384.615385/- Total amount = 9615.384615+384.615385/- = 10000/-
The Installment decided here Rs. 4902/- annually. In Which after 2 years we got Rs. 10400/- While it should be Rs. 10000/- So the formula is not accurate. As premium is much more and inappropriate.	Here the premium finalized Rs. 4713.423831/- annually for two years, at the rate of 4% interest yearly. We got matured value Rs. 10000/- finally which is accurate to sinking fund (S) Hence the evolved formula by me (M.K.Varshaney, Sr. Lecturer Civil Engg., D.N. Polytechnic, and Meerut) is quite accurate, precise and applicable for Engineers, Valuers, and Estimators & Designers for their practices in their profession.

Constant for evolved formula

In Simple way Imkv =Sk can be written, where $k = i/ (1+i)^{n+1} - (1+i)$ may be considered as constant for n & i.
so $Imkv = Si/ (1+i)^{n+1} - (1+i)$, while $k = i/ (1+i)^{n+1} - (1+i)$

The value of **Imkv** can be directly determined by multiplying sinking fund amount to the constants, exists with specific number of years i.e. n. with corresponding to the prevailing rate of annual interest in decimal. Here is the table of constant k with varied n & i.

% Interest / Nos. of years	i=1%=0.01	i=2%=0.02	i=0.03	i=4%=0.04
n=1	0.990099009	0.980392156	0.970873786	0.961538461
n=2	0.492586572	0.485342651	0.478262949	0.471342383
n=3	0.326754565	0.320347718	0.314107148	0.308027441
n=4	0.243842667	0.237866424	0.232065092	0.226432735
n=5	0.194098811	0.188390582	0.182868515	0.17752607
n=6	0.160938976	0.155417463	0.15009466	0.144963367
n=7	0.137255725	0.131874466	0.126705197	0.121740011
n=8	0.119496338	0.114225293	0.109180960	0.104353684
n=9	0.105683527	0.10050533	0.095566851	0.090858646

Just for an illustration if n=8years and i=2% or 0.02 and sinking fund decided 150000/-
Hence the premium or Imkv = 150000 X 0.114225293 = 17133.79395/- or Rs. 17133.80

Conclusion

Since observation to the analytical comparative cum tabulated form, it is clear that premium decided through earlier formula $\mathbf{I = Si/ (1+i)^n - 1}$ is more. Though the final matured amount is more then predecided amount, but the premium/Installment adjudgement is not to the correct value. This will certainly create a problem to the premium depositor. As we are existing in computer-internet age where highly accuracy is required there this formula $\mathbf{I = Si/ (1+i)^n - 1}$ will not stand against new one formula $\mathbf{Imkv = Si/ (1+i)^{n+1} - (1+i)}$ developed by the author.

As far as the new empirically formula evolved by the author is concern which is even then correct up to the sixth place to the decimal.