Никита Осипов, ПМ - 1801, 1.2.5. а) Методы сопряженных направлений. Метод ортогональных векторов

```
A = {{4.33, -1.12, -1.08, 1.14}, {-1.12, 4.33, 0.24, -1.22},
    {-1.08, 0.24, 7.21, -3.22}, {1.14, -1.22, -3.22, 5.43}};
f = {0.3, 0.5, 0.7, 0.9};


(*Ортогонализация матрицы A*)
Clear[ortg, mainOrtg]
ortg[A_] := Module[{D = {}, n = Length@A, s, At = Transpose@A},
  AppendTo[D, At[[1]]];
  For[i = 2, i ≤ n, i++,
   s = At[[i]] - ∑_{j=1}^{i-1} (At[[i]].D[[j]])/(At[[j]].D[[j]]) * D[[j]];
   AppendTo[D, s]];
  Transpose@D]

(*Решение системы*)
mainOrtg[A_, x_, f_, kr_] := Module[{D = ortg[A], Dt, x0 = x,
    n = Length@A, B, C, r0, At = Transpose@A, xOld, iter = 0},
  B = DiagonalMatrix[ConstantArray[1, n], 0, n];
  C = B;
  Dt = Transpose@D;
  For[i = 1, i ≤ n, i++,
   r0 = f - A.x0;
   x0 = x0 + B.∑_{i=1}^{n} ((C.r0).Dt[[i]])/((D.D[[i]]).Dt[[i]]) * Dt[[i]];
   If[i ≠ 1,
    If[Total@Boole@Positive[kr - (x0 - xOld)] < Length@kr, Nothing, iter = i;
     Break[]]];
   xOld = x0];
  If[iter == 0, iter = n];
  {xOld - x0, x0, A.x0, iter}]


result = mainOrtg[A, {0.1, 0.01, 0.001, 0.001}, f, {10^-4, 10^-4, 10^-4, 10^-4}];
```

```
In[•]:= Grid[{{"A", , "x", , "f"},
    {MatrixForm@A, "*", MatrixForm@result[[2]], "=", MatrixForm@result[[3]]},
    {"", "", "", "", ""},
    {"Кол-во итераций", "", "Приближение", "", ""}, {result[[4]], "", "10^-4", "", ""}}]
```

Out[•]=

A					x		f
4.33	−1.12	−1.08	1.14	*	0.0985545	=	0.292367
−1.12	4.33	0.24	−1.22		0.224517		0.498508
−1.08	0.24	7.21	−3.22		0.259851		0.697571
1.14	−1.22	−3.22	5.43		0.348881		0.896146

Кол-во итераций	Приближение
4	10^{-4}