```
> restart
> with(LinearAlgebra)
```

(1)

```
[&x, Add, Adjoint, BackwardSubstitute, BandMatrix, Basis, BezoutMatrix, BidiagonalForm,
  BilinearForm, CARE, CharacteristicMatrix, CharacteristicPolynomial, Column,
  ColumnDimension, ColumnOperation, ColumnSpace, CompanionMatrix,
  CompressedSparseForm, ConditionNumber, ConstantMatrix, ConstantVector, Copy,
  CreatePermutation, CrossProduct, DARE, DeleteColumn, DeleteRow, Determinant,
  Diagonal, DiagonalMatrix, Dimension, Dimensions, DotProduct, EigenConditionNumbers,
  Eigenvalues, Eigenvectors, Equal, ForwardSubstitute, FrobeniusForm,
  FromCompressedSparseForm, FromSplitForm, GaussianElimination, GenerateEquations,
  GenerateMatrix, Generic, GetResultDataType, GetResultShape, GivensRotationMatrix,
  GramSchmidt, HankelMatrix, HermiteForm, HermitianTranspose, HessenbergForm,
  HilbertMatrix, HouseholderMatrix, IdentityMatrix, IntersectionBasis, IsDefinite,
  IsOrthogonal, IsSimilar, IsUnitary, JordanBlockMatrix, JordanForm, KroneckerProduct,
  LA_Main, LUDecomposition, LeastSquares, LinearSolve, LyapunovSolve, Map, Map2,
  MatrixAdd, MatrixExponential, MatrixFunction, MatrixInverse, MatrixMatrixMultiply,
  MatrixNorm, MatrixPower, MatrixScalarMultiply, MatrixVectorMultiply,
  MinimalPolynomial, Minor, Modular, Multiply, NoUserValue, Norm, Normalize,
  NullSpace, OuterProductMatrix, Permanent, Pivot, PopovForm, ProjectionMatrix,
  QRDecomposition, RandomMatrix, RandomVector, Rank, RationalCanonicalForm,
  ReducedRowEchelonForm, Row, RowDimension, RowOperation, RowSpace, ScalarMatrix,
  ScalarMultiply, ScalarVector, SchurForm, SingularValues, SmithForm, SplitForm,
  StronglyConnectedBlocks, SubMatrix, SubVector, SumBasis, SylvesterMatrix,
  SylvesterSolve, ToeplitzMatrix, Trace, Transpose, TridiagonalForm, UnitVector,
  VandermondeMatrix, VectorAdd, VectorAngle, VectorMatrixMultiply, VectorNorm,
  VectorScalarMultiply, ZeroMatrix, ZeroVector, Zip ]
```

```
> A := Matrix([[ 2.191489,  0.0869152,  0.8279362,  0.5334933,  0.375243,   0.3672222,
    0.0968153,  0.7886894,  0.9305822,  0.1335048 ],
  [ 0.1809336,  2.3599438,  0.7960174,  0.4092807,  0.9900186 , 0.277269,
    0.0251958,  0.3093025,  0.2317656,  0.8699428 ],
  [ 0.1507688 , 0.7677984,  2.454561,   0.215663,   0.9470161,  0.9121592,
    0.0880068 , 0.3078117,  0.6675039,  0.6036517 ],
  [ 0.5180142,  0.5264675 , 0.1915474,  2.0045807 , 0.5770334 , 0.9771822,
    0.8813081,  0.5181077 , 0.1464847,  0.8551703 ],
  [ 0.9058419,  0.8494655,  0.0921422,  0.2569904,  1.9722537,  0.1795926,
    0.2596057,  0.7514084,  0.261258,   0.4449708 ],
  [ 0.8927505,  0.595963,   0.758821,   0.2638501,  0.8952259,  2.7710784,
    0.5853018,  0.4921802,  0.6974679,  0.2383001 ],
  [ 0.0295571,  0.486005,   0.8665615,  0.1049571,  0.1980051,  0.5190647,
    2.5916859,  0.3676201,  0.0814937,  0.49547   ],
  [ 0.6774982,  0.4005898 , 0.8906801,  0.3909964,  0.0262317,  0.0240633,
    0.7611217,  2.259136,   0.410222,   0.7606841 ],
  [ 0.1520384,  0.3292257,  0.0131486,  0.1227146,  0.5051157 , 0.4677612,
    0.2729393,  0.6320958,  2.0344747,  0.1798599 ],
  [ 0.2179066 , 0.2826244,  0.9151035,  0.5044386,  0.5772322,  0.1669885,
```

0.9266215 , 0.1846557, 0.5225408, 2.1408565]]);

$$A := [[2.191489, 0.0869152, 0.8279362, 0.5334933, 0.375243, 0.3672222, 0.0968153, 0.7886894, 0.9305822, 0.1335048], [0.1809336, 2.3599438, 0.7960174, 0.4092807, 0.9900186, 0.277269, 0.0251958, 0.3093025, 0.2317656, 0.8699428], [0.1507688, 0.7677984, 2.454561, 0.215663, 0.9470161, 0.9121592, 0.0880068, 0.3078117, 0.6675039, 0.6036517], [0.5180142, 0.5264675, 0.1915474, 2.0045807, 0.5770334, 0.9771822, 0.8813081, 0.5181077, 0.1464847, 0.8551703], [0.9058419, 0.8494655, 0.0921422, 0.2569904, 1.9722537, 0.1795926, 0.2596057, 0.7514084, 0.261258, 0.4449708], [0.8927505, 0.595963, 0.758821, 0.2638501, 0.8952259, 2.7710784, 0.5853018, 0.4921802, 0.6974679, 0.2383001], [0.0295571, 0.486005, 0.8665615, 0.1049571, 0.1980051, 0.5190647, 2.5916859, 0.3676201, 0.0814937, 0.49547], [0.6774982, 0.4005898, 0.8906801, 0.3909964, 0.0262317, 0.0240633, 0.7611217, 2.259136, 0.410222, 0.7606841], [0.1520384, 0.3292257, 0.0131486, 0.1227146, 0.5051157, 0.4677612, 0.2729393, 0.6320958, 2.0344747, 0.1798599], [0.2179066, 0.2826244, 0.9151035, 0.5044386, 0.5772322, 0.1669885, 0.9266215, 0.1846557, 0.5225408, 2.1408565]] \quad (2)$$

> $u := Vector([\ 3.4973496,\ 3.1826006,\ 3.424393,\ \ 2.926963,\ 3.5773956,\ 3.4078488,\ 1.945066,\ \ 4.0296256\ ,\ 1.9324165,\ 3.3537391\ ]);$

$$u := \begin{bmatrix} 3.4973496 \\ 3.1826006 \\ 3.424393 \\ 2.926963 \\ 3.5773956 \\ 3.4078488 \\ 1.945066 \\ 4.0296256 \\ 1.9324165 \\ 3.3537391 \end{bmatrix} \quad (3)$$

>

> $z := LinearSolve(A, u);$

$$z := \begin{bmatrix} 0.710756563848429 \\ 0.334975288686626 \\ 0.494348371785814 \\ 0.175722340677959 \\ 0.696471489654827 \\ 0.236796381594992 \\ 0.114172690295269 \\ 0.923919140214322 \\ 0.227701558080217 \\ 0.806319388891365 \end{bmatrix} \quad \textbf{(4)}$$

```
> A1 := Matrix([[ 2.191489,  0.0869152,  0.8279362,  0.5334933,  0.375243,   0.3672222,
    0.0968153,  0.7886894,  0.9305822,  0.1335048],
   [ 0.1809336,  2.3599438,  0.7960174,  0.4092807,  0.9900186 , 0.277269,
    0.0251958,  0.3093025,  0.2317656,  0.8699428],
   [ 0.1507688 , 0.7677984,  2.454561,   0.215663,   0.9470161,  0.9121592,
    0.0880068 , 0.3078117,  0.6675039,  0.6036517],
   [ 0.5180142,  0.5264675 , 0.1915474,  2.0045807 , 0.5770334 , 0.9771822,
    0.8813081,  0.5181077 , 0.1464847,  0.8551703],
   [ 0.9058419,  0.8494655,  0.0921422,  0.2569904,  1.9722537,  0.1795926,
    0.2596057,  0.7514084,  0.261258,   0.4449708],
   [ 0.8927505,  0.595963,   0.758821,   0.2638501,  0.8952259,  2.7710784,
    0.5853018,  0.4921802,  0.6974679,  0.2383001],
   [ 0.0295571,  0.486005,   0.8665615,  0.1049571,  0.1980051,  0.5190647,
    2.5916859,  0.3676201,  0.0814937,  0.49547   ],
   [ 0.6774982,  0.4005898 , 0.8906801,  0.3909964,  0.0262317,  0.0240633,
    0.7611217,  2.259136,   0.410222,   0.7606841]]);
```

$$A1 := [[2.191489, 0.0869152, 0.8279362, 0.5334933, 0.375243, 0.3672222, 0.0968153, 0.7886894, 0.9305822, 0.1335048], [0.1809336, 2.3599438, 0.7960174, 0.4092807, 0.9900186, 0.277269, 0.0251958, 0.3093025, 0.2317656, 0.8699428], [0.1507688, 0.7677984, 2.454561, 0.215663, 0.9470161, 0.9121592, 0.0880068, 0.3078117, 0.6675039, 0.6036517], [0.5180142, 0.5264675, 0.1915474, 2.0045807, 0.5770334, 0.9771822, 0.8813081, 0.5181077, 0.1464847, 0.8551703], [0.9058419, 0.8494655, 0.0921422, 0.2569904, 1.9722537, 0.1795926, 0.2596057, 0.7514084, 0.261258, 0.4449708], [0.8927505, 0.595963, 0.758821, 0.2638501, 0.8952259, 2.7710784, 0.5853018, 0.4921802, 0.6974679, 0.2383001], [0.0295571, 0.486005, 0.8665615, 0.1049571, 0.1980051, 0.5190647, 2.5916859, 0.3676201, 0.0814937, 0.49547], [0.6774982, 0.4005898, 0.8906801, 0.3909964, 0.0262317, 0.0240633, 0.7611217, \quad \textbf{(5)}$$

```
    2.259136, 0.410222, 0.7606841 ]]
> u1 := Vector([ 3.4973496, 3.1826006, 3.424393,  2.926963, 3.5773956, 3.4078488,
    1.945066,  4.0296256 ]);
```

$$u1 := \begin{bmatrix} 3.4973496 \\ 3.1826006 \\ 3.424393 \\ 2.926963 \\ 3.5773956 \\ 3.4078488 \\ 1.945066 \\ 4.0296256 \end{bmatrix} \tag{6}$$

```
> z1 := LinearSolve(A1, u1);
```

$$z1 := \begin{bmatrix} 0.664248366650712 - 0.334546225626174\ \_t0_2 + 0.152154215454668\ \_t0_1 \\ 0.527597188735546 - 0.00536301419146807\ \_t0_2 - 0.237375828980969\ \_t0_1 \\ 0.642877640411587 - 0.228070174438584\ \_t0_2 - 0.119800337044227\ \_t0_1 \\ 0.415882330053850 + 0.0539591568784418\ \_t0_2 - 0.313085083836201\ \_t0_1 \\ 0.736874323352780 + 0.0363364823918758\ \_t0_2 - 0.0603690150880089\ \_t0_1 \\ 0.220017313569640 - 0.107877231396878\ \_t0_2 + 0.0512735800048730\ \_t0_1 \\ 0.155484526884770 + 0.0694563442994125\ \_t0_2 - 0.0708492877538001\ \_t0_1 \\ 1.10222456893481 - 0.0223985861061430\ \_t0_2 - 0.214809712071374\ \_t0_1 \\ \_t0_2 \\ \_t0_1 \end{bmatrix} \tag{7}$$

```
>
> func = sqrt(z1[1]^2 + z1[2]^2 + z1[3]^2 + z1[4]^2 + z1[5]^2 + z1[6]^2 + z1[7]^2 + z1[8]^2 + z1[9]^2
    + z1[10]^2)
```

$$\begin{aligned} func = {} & \left(0.664248366650712 - 0.334546225626174\ \_t0_2 + 0.152154215454668\ \_t0_1\right)^2 \\ & + \left(0.527597188735546 - 0.00536301419146807\ \_t0_2 - 0.237375828980969\ \_t0_1\right)^2 \\ & + \left(0.642877640411587 - 0.228070174438584\ \_t0_2 - 0.119800337044227\ \_t0_1\right)^2 \\ & + \left(0.415882330053850 + 0.0539591568784418\ \_t0_2 - 0.313085083836201\ \_t0_1\right)^2 \\ & + \left(0.736874323352780 + 0.0363364823918758\ \_t0_2 - 0.0603690150880089\ \_t0_1\right)^2 \\ & + \left(0.220017313569640 - 0.107877231396878\ \_t0_2 + 0.0512735800048730\ \_t0_1\right)^2 \end{aligned} \tag{8}$$

$$+\left(0.155484526884770+0.0694563442994125\ \_t0_2-0.0708492877538001\ \_t0_1\right)^2$$
$$+\left(1.10222456893481-0.0223985861061430\ \_t0_2-0.214809712071374\ \_t0_1\right)^2+\_t0_2^2$$
$$+\_t0_1^2\Big)^{1/2}$$

```
> with(Optimization)
```

$$[ImportMPS, Interactive, LPSolve, LSSolve, Maximize, Minimize, NLPSolve, QPSolve] \quad (9)$$

```
> Minimize( sqrt( z1[1]^2 + z1[2]^2 + z1[3]^2 + z1[4]^2 + z1[5]^2 + z1[6]^2 + z1[7]^2 + z1[8]^2
      + z1[9]^2 + z1[10]^2) )
```

$$[1.67467531722136687, [\_t0_1 = 0.422201736579000, \_t0_2 = 0.320579456514438]] \quad (10)$$

```
> sol := subs( {_t0[1] = 0.422201736579000, _t0[2] = 0.320579456514438}, z1)
```

$$sol := \begin{bmatrix} 0.621239493461318 \\ 0.425657429338214 \\ 0.519183117500868 \\ 0.300995461139938 \\ 0.723035150122100 \\ 0.207081883879460 \\ 0.147838111664225 \\ 1.00435100889945 \\ 0.320579456514438 \\ 0.422201736579000 \end{bmatrix} \quad (11)$$

```
>
>
```