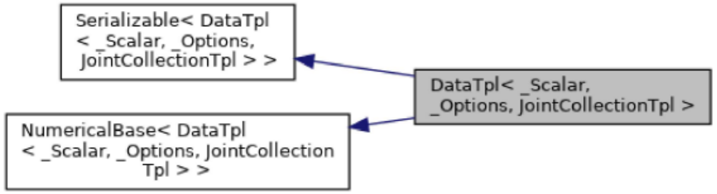
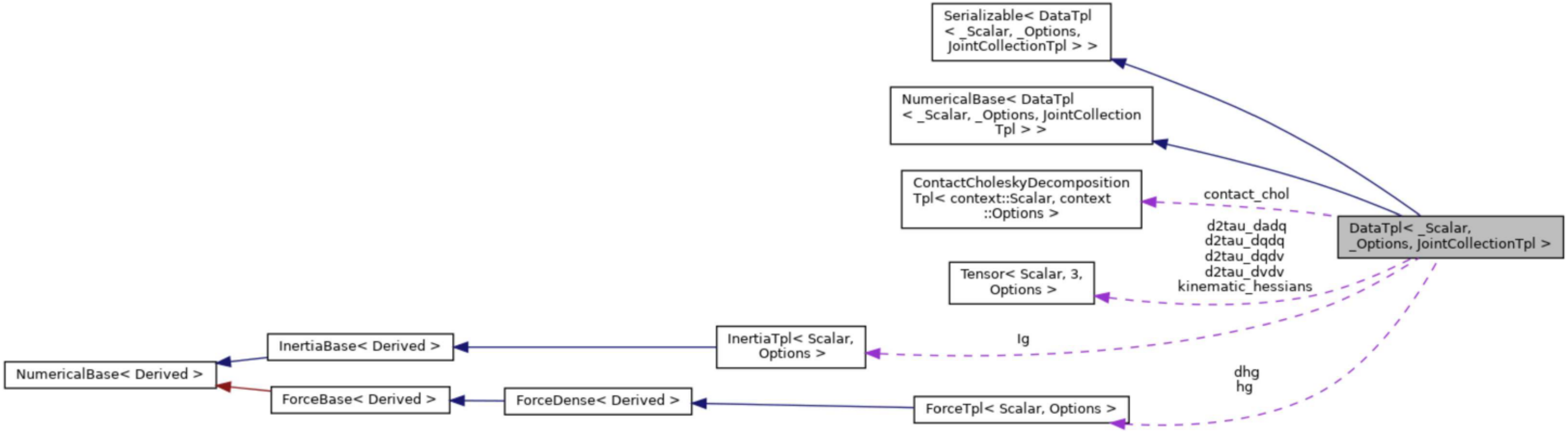
DataTpl< _Scalar, _Options, JointCollectionTpl > Struct Template Reference

Inheritance diagram for DataTpl< _Scalar, _Options, JointCollectionTpl >:



[legend]

Collaboration diagram for DataTpl< _Scalar, _Options, JointCollectionTpl >:



[legend]

Public Types

enum	{ **Options** = _Options }
typedef Eigen::Matrix< Scalar, 6, 10, Options >	**BodyRegressorType** The type of the body regressor.
typedef VectorXs	**ConfigVectorType** Dense vectorized version of a joint configuration vector.
typedef **ForceTpl**< Scalar, Options >	**Force**
typedef **FrameTpl**< Scalar, Options >	**Frame**
typedef pinocchio::FrameIndex	**FrameIndex**
typedef pinocchio::GeomIndex	**GeomIndex**
typedef pinocchio::Index	**Index**

typedef std::vector< Index >	**IndexVector**
typedef InertiaTpl< Scalar, Options >	**Inertia**
typedef JointCollectionTpl< Scalar, Options >	**JointCollection**
typedef JointDataTpl< Scalar, Options, JointCollectionTpl >	**JointData**
typedef pinocchio::JointIndex	**JointIndex**
typedef JointModelTpl< Scalar, Options, JointCollectionTpl >	**JointModel**
typedef Eigen::Matrix< Scalar, 3, Eigen::Dynamic, Options >	**Matrix3x** The 3d jacobian type (temporary)
typedef Eigen::Matrix< Scalar, 6, 6, Options >	**Matrix6**
typedef Eigen::Matrix< Scalar, 6, Eigen::Dynamic, Options >	**Matrix6x** The 6d jacobian type (temporary)
typedef Eigen::Matrix< Scalar, Eigen::Dynamic, Eigen::Dynamic, Options >	**MatrixXs**
typedef ModelTpl< Scalar, Options, JointCollectionTpl >	**Model**
typedef MotionTpl< Scalar, Options >	**Motion**
typedef Eigen::Matrix< Scalar, 6, 6, Eigen::RowMajor|Options >	**RowMatrix6**
typedef Eigen::Matrix< Scalar, Eigen::Dynamic, Eigen::Dynamic, Eigen::RowMajor|Options >	**RowMatrixXs**
typedef Eigen::Matrix< Scalar, 1, Eigen::Dynamic, Options|Eigen::RowMajor >	**RowVectorXs**
typedef _Scalar	**Scalar**
typedef SE3Tpl< Scalar, Options >	**SE3**
typedef VectorXs	**TangentVectorType** Dense vectorized version of a joint tangent vector (e.g. velocity, acceleration, etc). It also handles the notion of co-tangent vector (e.g. torque, etc).
typedef Tensor< Scalar, 3, Options >	**Tensor3x** More...
typedef Eigen::Matrix< Scalar, 3, 1, Options >	**Vector3**
typedef Eigen::Matrix< Scalar, 6, 1, Options >	**Vector6**
typedef Eigen::Matrix< Scalar, 6, 1, Options >	**Vector6c**
typedef Eigen::Matrix< Scalar, 1, 6, Eigen::RowMajor|Options >	**Vector6r**
typedef Eigen::Matrix< Scalar, Eigen::Dynamic, 1, Options >	**VectorXs**

▸ Public Types inherited from NumericalBase< DataTpl< _Scalar, _Options, JointCollectionTpl > >

Public Member Functions

	DataTpl () Default constructor.
	DataTpl (const Model &model) Default constructor of pinocchio::Data from a pinocchio::Model. More...
	PINOCCHIO_ALIGNED_STD_VECTOR (Force) f Vector of body forces expressed in the local frame of the joint. For each body, the force represents the sum of all external forces acting on the body.
	PINOCCHIO_ALIGNED_STD_VECTOR (Force) h Vector of spatial momenta expressed in the local frame of the joint.

	PINOCCHIO_ALIGNED_STD_VECTOR (Force) of Vector of body forces expressed at the origin of the world. For each body, the force represents the sum of all external forces acting on the body.
	PINOCCHIO_ALIGNED_STD_VECTOR (Force) of_augmented Vector of body forces expressed in the world frame. For each body, the force represents the sum of all external forces acting on the body. These forces are used in the context of augmented Lagrangian algorithms.
	PINOCCHIO_ALIGNED_STD_VECTOR (Force) oh Vector of spatial momenta expressed at the origin of the world.
	PINOCCHIO_ALIGNED_STD_VECTOR (Inertia) oinertias Rigid Body Inertia supported by the joint expressed in the world frame.
	PINOCCHIO_ALIGNED_STD_VECTOR (Inertia) oYcrb Composite Rigid Body Inertia expressed in the world frame.
	PINOCCHIO_ALIGNED_STD_VECTOR (Inertia) Ycrb Vector of sub-tree composite rigid body inertias, i.e. the apparent inertia of the subtree supported by the joint and expressed in the local frame of the joint..
	PINOCCHIO_ALIGNED_STD_VECTOR (int) const raint_ind
	PINOCCHIO_ALIGNED_STD_VECTOR (int) const raints_supported_dim
	PINOCCHIO_ALIGNED_STD_VECTOR (int) par_cons_ind
typedef	**PINOCCHIO_ALIGNED_STD_VECTOR** (JointData) JointDataVector
typedef	**PINOCCHIO_ALIGNED_STD_VECTOR** (JointModel) JointModelVector
	PINOCCHIO_ALIGNED_STD_VECTOR (Matrix6) B Combined variations of the inertia matrix $B_i = \frac{1}{2}[(v_i \times *)I_i + (I_i v_i) \times^* - I_i(v_i \times)]$ consistent with Christoffel symbols.
	PINOCCHIO_ALIGNED_STD_VECTOR (Matrix6) doYcrb Time variation of Composite Rigid Body Inertia expressed in the world frame.
	PINOCCHIO_ALIGNED_STD_VECTOR (Matrix6) dYcrb Vector of sub-tree composite rigid body inertia time derivatives $\dot{Y}_{crb}$. See Data::Ycrb for more details.
	PINOCCHIO_ALIGNED_STD_VECTOR (Matrix6) extended_motion_propagator2
	PINOCCHIO_ALIGNED_STD_VECTOR (Matrix6) Ivx Left variation of the inertia matrix.
	PINOCCHIO_ALIGNED_STD_VECTOR (Matrix6) oK Inverse articulated inertia.
	PINOCCHIO_ALIGNED_STD_VECTOR (Matrix6) oL Acceleration propagator.
	PINOCCHIO_ALIGNED_STD_VECTOR (Matrix6) oYaba Articulated Body Inertia matrix of the subtree expressed in the WORLD coordinate frame.
	PINOCCHIO_ALIGNED_STD_VECTOR (Matrix6) spatial_inv_inertia
	PINOCCHIO_ALIGNED_STD_VECTOR (Matrix6) vxI Right variation of the inertia matrix.
	PINOCCHIO_ALIGNED_STD_VECTOR (Matrix6) Yaba Articulated Body Inertia matrix of the subtree expressed in the LOCAL coordinate frame of the joint.

PINOCCHIO_ALIGNED_STD_VECTOR (Matrix6x) Fcrb
Spatial forces set, used in CRBA and CCRBA.

PINOCCHIO_ALIGNED_STD_VECTOR (Matrix6x) KA

PINOCCHIO_ALIGNED_STD_VECTOR (MatrixXs) KAS

PINOCCHIO_ALIGNED_STD_VECTOR (MatrixXs) LA

PINOCCHIO_ALIGNED_STD_VECTOR (Motion) a
Vector of joint accelerations expressed in the local frame of the joint.

PINOCCHIO_ALIGNED_STD_VECTOR (Motion) a_bias

PINOCCHIO_ALIGNED_STD_VECTOR (Motion) a_gf
Vector of joint accelerations due to the gravity field.

PINOCCHIO_ALIGNED_STD_VECTOR (Motion) oa
Vector of joint accelerations expressed at the origin of the world.

PINOCCHIO_ALIGNED_STD_VECTOR (Motion) oa_augmented
Vector of joint accelerations expressed at the origin of the world. These accelerations are used in the context of augmented Lagrangian algorithms.

PINOCCHIO_ALIGNED_STD_VECTOR (Motion) oa_drift
Vector of joint accelerations expressed at the origin of the world. These accelerations are used in the context of augmented Lagrangian algorithms.

PINOCCHIO_ALIGNED_STD_VECTOR (Motion) oa_gf
Vector of joint accelerations expressed at the origin of the world including the gravity contribution.

PINOCCHIO_ALIGNED_STD_VECTOR (Motion) ov
Vector of joint velocities expressed at the origin of the world.

PINOCCHIO_ALIGNED_STD_VECTOR (Motion) v
Vector of joint velocities expressed in the local frame of the joint.

PINOCCHIO_ALIGNED_STD_VECTOR (SE3) iMf
Vector of joint placements wrt to algorithm end effector.

PINOCCHIO_ALIGNED_STD_VECTOR (SE3) liMi
Vector of relative joint placements (wrt the body parent).

PINOCCHIO_ALIGNED_STD_VECTOR (SE3) oMf
Vector of absolute operationnel frame placements (wrt the world).

PINOCCHIO_ALIGNED_STD_VECTOR (SE3) oMi
Vector of absolute joint placements (wrt the world).

PINOCCHIO_ALIGNED_STD_VECTOR (size_t) accumulation_ancestor

PINOCCHIO_ALIGNED_STD_VECTOR (size_t) accumulation_descendant

PINOCCHIO_ALIGNED_STD_VECTOR (size_t) accumulation_joints

PINOCCHIO_ALIGNED_STD_VECTOR (size_t) joints_supporting_constraints

PINOCCHIO_ALIGNED_STD_VECTOR (std::set< size_t >) const raints_supported

PINOCCHIO_ALIGNED_STD_VECTOR (std::vector< size_t >) const raints_on_joint

PINOCCHIO_ALIGNED_STD_VECTOR (Vector3) acom
Vector of subtree center of mass linear accelerations expressed in the root joint of the subtree. In other words, acom[j] is the CoM linear acceleration of the subtree supported by joint j and expressed in the joint frame j. The

	element acom[0] corresponds to the acceleration of the CoM of the whole model expressed in the global frame.
	PINOCCHIO_ALIGNED_STD_VECTOR (Vector3) com Vector of subtree center of mass positions expressed in the root joint of the subtree. In other words, com[j] is the CoM position of the subtree supported by joint j and expressed in the joint frame j. The element com[0] corresponds to the center of mass position of the whole model and expressed in the global frame.
	PINOCCHIO_ALIGNED_STD_VECTOR (Vector3) vcom Vector of subtree center of mass linear velocities expressed in the root joint of the subtree. In other words, vcom[j] is the CoM linear velocity of the subtree supported by joint j and expressed in the joint frame j. The element vcom[0] corresponds to the velocity of the CoM of the whole model expressed in the global frame.
	PINOCCHIO_ALIGNED_STD_VECTOR (VectorXs) IA
	PINOCCHIO_ALIGNED_STD_VECTOR (VectorXs) lambdaA

▸ Public Member Functions inherited from **Serializable< DataTpl< _Scalar, _Options, JointCollectionTpl > >**

Public Attributes

Matrix6x	**Ag** Centroidal Momentum Matrix. More...
BodyRegressorType	**bodyRegressor** Body regressor.
MatrixXs	**C** The Coriolis matrix (a square matrix of dim model.nv).
ContactCholeskyDecomposition	**contact_chol** Cholesky decomposition of the KKT contact matrix.
PINOCCHIO_COMPILER_DIAGNOSTIC_PUSH PINOCCHIO_COMPILER_DIAGNOSTIC_IGNORED_DEPRECECATED_DECLARATIONS typedef **ContactCholeskyDecompositionTpl**< Scalar, Options >	**ContactCholeskyDecomposition**
VectorXs	**D** Diagonal of the joint space intertia matrix obtained by a Cholesky Decomposition.
Tensor3x	**d2tau_dadq** SO Cross-Partial derivative of the joint torque vector with respect to the joint acceleration/configuration. This also equals to the first-order partial derivative of the Mass Matrix w.r.t joint configuration.
Tensor3x	**d2tau_dqdq** SO Partial derivative of the joint torque vector with respect to the joint configuration.
Tensor3x	**d2tau_dqdv** SO Cross-Partial derivative of the joint torque vector with respect to the joint configuration/velocity.
Tensor3x	**d2tau_dvdv** SO Partial derivative of the joint torque vector with respect to the joint velocity.
MatrixXs	**dac_da**
MatrixXs	**dac_dq**
MatrixXs	**dac_dv**
Matrix6x	**dAdq** Variation of the spatial acceleration set with respect to the joint configuration.

Matrix6x	**dAdv** Variation of the spatial acceleration set with respect to the joint velocity.
Matrix6x	**dAg** Centroidal Momentum Matrix Time Variation. More...
Matrix6x	**ddJ** Second derivative of the Jacobian with respect to the time.
TangentVectorType	**ddq** The joint accelerations computed from ABA.
RowMatrixXs	**ddq_dq** Partial derivative of the joint acceleration vector with respect to the joint configuration.
RowMatrixXs	**ddq_dtau** Partial derivative of the joint acceleration vector with respect to the joint torques.
RowMatrixXs	**ddq_dv** Partial derivative of the joint acceleration vector with respect to the joint velocity.
Matrix6x	**dFda** Variation of the forceset with respect to the joint acceleration.
Matrix6x	**dFdq** Variation of the forceset with respect to the joint configuration.
Matrix6x	**dFdv** Variation of the forceset with respect to the joint velocity.
Matrix6x	**dHdq** Variation of the spatial momenta set with respect to the joint configuration.
Force	**dhg** Centroidal momentum time derivative. More...
VectorXs	**diff_lambda_c** Difference between two consecutive iterations of the proxy algorithm.
VectorXs	**Dinv** Diagonal inverse of the joint space intertia matrix obtained by a Cholesky Decomposition.
Matrix6x	**dJ** Derivative of the Jacobian with respect to the time.
MatrixXs	**dlambda_dq** Partial derivatives of the constraints forces with respect to the joint configuration, velocity and torque;.
MatrixXs	**dlambda_dtau**
MatrixXs	**dlambda_dv**
MatrixXs	**dlambda_dx_prox**
TangentVectorType	**dq_after** Generalized velocity after impact.
MatrixXs	**drhs_prox**
RowMatrixXs	**dtau_dq** Partial derivative of the joint torque vector with respect to the joint configuration.

RowMatrixXs	**dtau_dv** Partial derivative of the joint torque vector with respect to the joint velocity.
MatrixXs	**dvc_dq** Stack of partial derivative of the contact frame acceleration with respect to the joint parameters.
Matrix6x	**dVdq** Variation of the spatial velocity set with respect to the joint configuration.
std::vector< int >	**end_idx_v_fromRow** End index of the Joint motion subspace.
	extended_motion_propagator
VectorXs	**g** Vector of generalized gravity (dim model.nv). More...
Force	**hg** Centroidal momentum quantity. More...
Inertia	**Ig** Centroidal Composite Rigid Body Inertia. More...
VectorXs	**impulse_c** Lagrange Multipliers corresponding to the contact impulses in **pinocchio::impulseDynamics**.
Matrix6x	**IS** Used in computeMinverse.
Matrix6	**Itmp** Temporary for derivative algorithms.
Matrix6x	**J** Jacobian of joint placements. More...
Matrix3x	**Jcom** Jacobian of center of mass. More...
MatrixXs	**JMinvJt** Inverse of the operational-space inertia matrix.
PINOCCHIO_COMPILER_DIAGNOSTIC_POP JointDataVector	**joints** Vector of pinocchio::JointData associated to the pinocchio::JointModel stored in model, encapsulated in JointDataAccessor.
MatrixXs	**jointTorqueRegressor** Matrix related to joint torque regressor.
Tensor3x	**kinematic_hessians** **Tensor** containing the kinematic Hessian of all the joints.
Scalar	**kinetic_energy** Kinetic energy of the system.
RowVectorXs	**kineticEnergyRegressor** Matrix related to kinetic energy regressor.
VectorXs	**lambda_c** Lagrange Multipliers corresponding to the contact forces in **pinocchio::forwardDynamics**.
VectorXs	**lambda_c_prox**

	Proximal Lagrange Multipliers used in the computation of the Forward Dynamics computations.
std::vector< int >	**lastChild** Index of the last child (for CRBA)
Eigen::LLT< MatrixXs >	**llt_JMinvJt** Cholesky decompostion of $JMinvJt$.
MatrixXs	**M** The joint space inertia matrix (a square matrix of dim model.nv).
Matrix6	**M6tmp** Temporary for derivative algorithms.
RowMatrix6	**M6tmpR**
RowMatrix6	**M6tmpR2**
std::vector< Scalar >	**mass** Vector of subtree mass. In other words, mass[j] is the mass of the subtree supported by joint j. The element mass[0] corresponds to the total mass of the model.
Scalar	**mechanical_energy** Mechanical energy of the system.
RowMatrixXs	**Minv** The inverse of the joint space inertia matrix (a square matrix of dim model.nv).
VectorXs	**nle** Vector of Non Linear Effects (dim model.nv). It corresponds to concatenation of the Coriolis, centrifugal and gravitational effects. More...
std::vector< int >	**nvSubtree** Dimension of the subtree motion space (for CRBA)
std::vector< int >	**nvSubtree_fromRow** Subtree of the current row index (used in Cholesky Decomposition).
MatrixXs	**osim** Operational space inertia matrix;.
Eigen::LLT< MatrixXs >	**osim_llt**
	oYaba_contact Articulated Body Inertia matrix with contact apparent inertia, of a given the subtree and expressed in the WORLD coordinate frame.
std::vector< int >	**parents_fromRow** First previous non-zero row in M (used in Cholesky Decomposition).
Scalar	**potential_energy** Potential energy of the system.
RowVectorXs	**potentialEnergyRegressor** Matrix related to potential energy regressor.
VectorXs	**primal_dual_contact_solution** RHS vector when solving the contact dynamics KKT problem.
VectorXs	**primal_rhs_contact** Primal RHS in contact dynamic equations.

Matrix6x	**psid** psidot Derivative of Jacobian w.r.t to the parent body moving v(p(j)) x Sj
Matrix6x	**psidd** psiddot Second Derivative of Jacobian w.r.t to the parent body moving a(p(j)) x Sj + v(p(j)) x psidj
Matrix6x	**SDinv** Used in computeMinverse.
MatrixXs	**sDUiJt** Temporary corresponding to $\sqrt{D}U^{-1}J^{\top}$.
std::vector< int >	**start_idx_v_fromRow** Starting index of the Joint motion subspace.
Matrix3x	**staticRegressor** Matrix related to static regressor.
std::vector< std::vector< int > >	**supports_fromRow** Each element of this vector corresponds to the ordered list of indexes belonging to the supporting tree of the given index at the row level. It may be helpful to retrieve the sparsity pattern through it.
TangentVectorType	**tau** Vector of joint torques (dim model.nv).
VectorXs	**tmp** Temporary of size NV used in Cholesky Decomposition.
VectorXs	**torque_residual** Temporary corresponding to the residual torque $\tau - b(q,\dot{q})$.
TangentVectorType	**u** Intermediate quantity corresponding to apparent torque [ABA].
MatrixXs	**U** Joint space intertia matrix square root (upper trianglular part) computed with a Cholesky Decomposition.
Matrix6x	**UDinv** Used in computeMinverse.

Detailed Description

template<typename _Scalar, int _Options, template< typename, int > class JointCollectionTpl>
struct pinocchio::DataTpl< _Scalar, _Options, JointCollectionTpl >

Definition at line 40 of file data.hpp.

Member Typedef Documentation

◆ Tensor3x

typedef **Tensor**<Scalar, 3, Options> **Tensor3x**

The type of **Tensor** for Kinematics and Dynamics second order derivatives

Definition at line **105** of file **data.hpp**.

Constructor & Destructor Documentation

◆ DataTpl()

DataTpl (const **Model** & model) explicit

Default constructor of pinocchio::Data from a pinocchio::Model.

Parameters

`[in]` **model** The model structure of the rigid body system.

Member Data Documentation

◆ Ag

Matrix6x Ag

Centroidal Momentum Matrix.

Note

$hg = A_g \dot{q}$ maps the joint velocity set to the centroidal momentum.

Definition at line **284** of file **data.hpp**.

◆ dAg

Matrix6x dAg

Centroidal Momentum Matrix Time Variation.

Note

$\dot{h}_g = A_g \ddot{q} + \dot{A}_g \dot{q}$ maps the joint velocity and acceleration vectors to the time variation of the centroidal momentum.

Definition at line 290 of file data.hpp.

◆ dhg

Force dhg

Centroidal momentum time derivative.

Note

The centroidal momentum time derivative is expressed in the frame centered at the CoM and aligned with the inertial frame (i.e. the world frame).

$\dot{h}_g = \left(m\ddot{c}, \dot{L}_g \right)$;. $\dot{h}_g$ is the stack of the linear momentum variation and the angular momemtum variation.

Definition at line 305 of file data.hpp.

◆ g

VectorXs g

Vector of generalized gravity (dim model.nv).

Note

In the multibody dynamics equation $M\ddot{q} + c(q, \dot{q}) + g(q) = \tau$, the gravity effect is associated to the g term.

Definition at line 184 of file data.hpp.

◆ hg

Force hg

Centroidal momentum quantity.

Note

The centroidal momentum is expressed in the frame centered at the CoM and aligned with the inertial frame (i.e. the world frame).

$h_g = \left(m\dot{c}, L_g \right);$. h_g is the stack of the linear momentum and the angular momemtum vectors.

Definition at line 297 of file data.hpp.

◆ Ig

Inertia Ig

Centroidal Composite Rigid Body Inertia.

Note

$hg = Igv_{\text{mean}}$ map a mean velocity to the current centroidal momentum quantity.

Definition at line 310 of file data.hpp.

◆ J

Matrix6x J

Jacobian of joint placements.

Note

The columns of J corresponds to the basis of the spatial velocities of each joint and expressed at the origin of the inertial frame. In other words, if $v_{J_i} = S_i \dot{q}_i$ is the relative velocity of the joint i regarding to its parent, then $J = \begin{bmatrix} {}^0X_1 S_1 & \cdots & {}^0X_i S_i & \cdots & {}^0X_{\text{nj}} S_{\text{nj}} \end{bmatrix}$. This Jacobian has no special meaning. To get the jacobian of a precise joint, you need to call pinocchio::getJointJacobian

Definition at line 360 of file data.hpp.

◆ Jcom

Matrix3x Jcom

Jacobian of center of mass.

Note

This Jacobian maps the joint velocity vector to the velocity of the center of mass, expressed in the inertial frame. In other words, $v_{\text{CoM}} = J_{\text{CoM}} \dot{q}$.

Definition at line 450 of file data.hpp.

◆ nle

VectorXs nle

Vector of Non Linear Effects (dim model.nv). It corresponds to concatenation of the Coriolis, centrifugal and gravitational effects.

Note

In the multibody dynamics equation $M\ddot{q} + b(q, \dot{q}) = \tau$, the non linear effects are associated to the term b.

Definition at line 179 of file data.hpp.

The documentation for this struct was generated from the following files:

- include/pinocchio/context/generic.hpp
- include/pinocchio/multibody/data.hpp