qcleanNEWTON — componentwise cleanup (zeroing) of quaternion arrays

Zero small components of a quaternion array to improve readability and promote sparsity.

Setup

```
hasQuat = true;
try
    quaternion(0,0,0,0);
catch
    hasQuat = false;
end
if ~hasQuat
    disp('This toolbox requires MATLAB''s built-in quaternion class
(quaternion(w,x,y,z)).');
    disp('Examples in this page are skipped.');
    return;
end

if exist('qcleanNEWTON','file') ~= 2
    thisFile = mfilename('fullpath');
    if ~isempty(thisFile)
        rootGuess = fileparts(fileparts(fileparts(thisFile))); % .../docs/source ->
toolbox root
        if exist(fullfile(rootGuess,'qcleanNEWTON.m'),'file')
            addpath(rootGuess);
            rehash toolboxcache
        end
    end
end

if exist('qcleanNEWTON','file') ~= 2
    error('qcleanNEWTON not found on the MATLAB path. Add the toolbox root
folder.');
end
```

Syntax

- `Y = qcleanNEWTON(X)`
- `Y = qcleanNEWTON(X, tol)`

Notes

- Cleaning is ***componentwise***: it does not preserve unit quaternions.
- If X represents rotations, re-normalize after cleaning.

Example 1: a single quaternion (before/after)

```
q  = quaternion(1, 1e-14, -2e-13, 3);
q2 = qcleanNEWTON(q, 1e-12);

disp('Before:'); disp(q);
```

```
Before:
        1 + 1e-14i - 2e-13j +     3k
```

```
disp('After (tol=1e-12):'); disp(q2);
```

```
After (tol=1e-12):
     1 + 0i + 0j + 3k
```

Example 2: a matrix (before/after)

```
rng(1);
A  = quaternion(randn(3), 1e-14*randn(3), randn(3), zeros(3));
A2 = qcleanNEWTON(A, 1e-12);

disp('A (original):');  disp(A);
```

```
A (original):
       -0.64901 + 5.8644e-15i +     1.1752j +          0k        -1.1096 - 1.5094e-14i +    0.60366j +          0k
         1.1812 - 8.5189e-15i +     2.0292j +          0k       -0.84555 + 8.7587e-15i +     1.7813j +          0k
       -0.75845 + 8.0032e-15i -    0.27516j +          0k       -0.57266 - 2.4279e-15i +     1.7737j +          0k
```

```
disp('A2 (cleaned):');  disp(A2);
```

```
A2 (cleaned):
    -0.64901 +       0i +  1.1752j +       0k     -1.1096 +       0i + 0.60366j +       0k    -0.55868 +       0i -
      1.1812 +       0i +  2.0292j +       0k    -0.84555 +       0i +  1.7813j +       0k     0.17838 +       0i -
    -0.75845 +       0i - 0.27516j +       0k    -0.57266 +       0i +  1.7737j +       0k    -0.19686 +       0i -
```

```
% Quantify how much was removed in the tiny components
[~,bx,~,~] = parts(A);
[~,bx2,~,~] = parts(A2);
fprintf('Max |x|-component before: %.3e   after: %.3e\n', max(abs(bx(:))),
max(abs(bx2(:))));
```

```
Max |x|-component before: 1.965e-14   after: 0.000e+00
```

See also

qroundNEWTON, parts